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CIVIL ENGINEERING.

Twentieth Annual Report of the President and Directors to the Stockholders of the Baltimore and Ohio Railroad Company.

In submitting to the stockholders the twentieth annual report, the President and Directors of the Baltimore and Ohio Railroad Company have it in their power to state that the President, having returned to the United States, has resumed his duties at the head of the Company. Returning to his post only at the close of the year, however, it has been thought best that the general operations of the Company should be stated by the President pro tempore, by whom they were conducted; and for that purpose the Board refer to his letter addressed to the President, and dated the 7th of the present month.

The affairs of the Company are accurately exhibited in the following and annexed statements.

The statement A presents the state of the Company's affairs on the 30th ultimo; and the revenue and expenses of the Main Stem for the year ending on the same day, are shown by the statement B.

The tabular statement marked C, prepared by the Engineer of machinery and repairs, presents in detail the operations of the main stem, and the actual expenses of working that part of the road during the year; together with the amount of receipts from all sources during the same period. And, in order that the series of these statements should

be made complete, a similar statement in regard to the main stem during the year ending the 30th September, 1845, and omitted in the report of that year, is here supplied, marked D.

These statements shew a steady increase in the transportation, both of passengers and burthen. It will be observed that the increase in the number, and in the revenue from the conveyance of passengers in the year just closed, compared with the preceding, has been more than fourteen per cent. During the same period, the augmentation in the amount of tonnage transported, has been more than thirty, and the increase in the revenue from the same source, as compared with the receipts of the preceding year, has exceeded twenty-six per cent. It will also appear from the comparative statements accompanying this report, that the cost of working the road has not been greater in proportion to the work done, than during the preceding year.

It will be seen that the nett revenue, including the receipts from the coal trade, after deducting the expenses of working and keeping the road in repair, amounted to the sum of $440,475·34—being $65,-713·60 greater than the previous year, and more than six per cent. upon the capital of the Company. Of this sum, however, besides $65,749·64 (being principal, interest, and premium in sterling bills,) on account of the debt due the Messrs. Baring, there have been applied during the year to the re-construction of the road, and to the construction of burthen cars adapted to the general trade, to improvements at the depots and to right of way, to the purchase of locomotive engines and the construction of water stations, to the purchase of additional power and machinery for the accommodation of an increasing coal trade, and on account of a subscription on behalf of the Company to the capital stock of the Pittsburg and Connellsville Railroad, the further sum of $284,184·76, making together $349,934·40—and leaving of the nett revenue of the year at the disposal of the Board the sum of $90,540·94—or about one and a quarter per cent.

The motives which justified the Board in determining upon the re-construction of the road, under the circumstances, are stated in the letter of the President, pro tempore. The Board could not doubt their sufficiency, and they were believed to be too urgent to admit of delay. The Board at the same time determined to raise the means for the re-construction of the entire length of the road between Harper's Ferry and Baltimore, by the sale of the Company's six-per cent. bonds, payable in twenty years; and believing that a sufficient sum for this purpose might in this way be raised in season to meet their engagements, they directed thirty miles of the road to be immediately placed under contract. The contracts were accordingly made, and the work embraced in them will cost not less than $316,800—and may be expected to be completed before the first day of March next.

The sale of the Company's bonds, however, was not effected according to the expectation of the Board; and, to meet the payments under the contract, it became necessary to sell the bonds at a sacrifice varying from 8 to 10 per cent., or temporarily to apply the revenue of the year, to be hereafter reimbursed from future loans. The Board

thought they best consulted the interests of the stockholders in adopting the latter alternative.

It would seem also that time had now arrived when the Board should make some definite arrangement for the reimbursement to the stockholders of the monies taken from the annual revenue and applied to the purchase of the power and machinery on account of the transportation of coal.

The coal trade in its origin, was, in some degree, experimental, and intended, for the most part, to be confined to special contracts, comprehending large amounts, to be conducted with particular regularity and at times different from the general miscellaneous business. It was intended, therefore to embrace this particular branch of transportation in a distinct account, and by charging it only with the capital actually employed and the expense of conducting it, apart from other transportation,—to be able to trace with greater certainty the results of the trade, and the extent to which it might hereafter be advantageously carried on. These objects were stated in the answers of the Board to the inquiries of the legislature, in 1844; and in the annual report of the same year, the Board acquainted the stockholders that for the purpose of successfully conducting this trade they had borrowed the capital from the revenue, and of their intention to reimburse it from the profits of the trade. The capacity to transport coal, however, at cheap rates and at a good profit, it appears has been practically ascertained; the trade itself, in consequence of the operations at the mines, and the nature of the demand, has already extended beyond the limits of special, defined contracts, and there is neither any necessity for, nor advantage in, continuing the separation of this from the other branches of transportation. The determination recently made of re-constructing the entire road between Harper's Ferry and Baltimore from the general funds of the Company, superadds another reason why the expenditures on account of the transportation of coal should hereafter be placed upon the same footing as all others incurred on account of the miscellaneous trade of the road.

Under these circumstances, the Board deem it only reasonable now to return to the stockholders what has been taken from the revenue during the past year, for the purposes of the coal trade; and for its conduct in future to rely upon the same provision as is usually made for transportation of any other description.

Upon this principle, adding the sums applied from the revenue for the re-construction of the road, and for the power and machinery for the coal trade, (after deducting the sum of $43,312·14, with which that trade has been credited,) amounting together to $146,816·05, to the residue of the surplus, as above stated, there would remain a nett surplus of revenue, over and above all other expenditures, of $237,-356·99.

As a distribution of this amount among the stockholders could only be effected by a sale of the Company's bonds at the depreciation already stated, or by the delivery of the bonds at their par value to the stockholders, it became necessary to decide, not only the alternative thus presented, but the expediency of dividing only the balance of

revenue actually in hand, amounting, as already shown, to about one and a quarter per cent.

In considering these questions, the Board had reason to believe that, with a knowledge of the general increase in the trade and revenues of the Company, if not on other grounds, the stockholders generally, including the state and city, had been led to expect a dividend of at least three per cent., and it was officially represented that the authorities of the city, relying upon that expectation, had omitted to make any other than a correspondent provision for the accruing interest upon the city debt.

Yielding the fullest force to these considerations, it was, at the same time, deemed inexpedient to reimburse the amount applied from the revenue to the objects already stated by a sale of the Company's bonds at so great a depreciation, and at rates which might have a tendency to impair their value in future, at least until an opportunity could be afforded of adopting reasonable means calculated to establish their just and full value.

Up to this time, the amount of bonds which the Company proposed to issue, and the specific pledge by which it was designed to secure the payment of both principal and interest, had not been limited or defined, and this had a tendency to depreciate their price. The bonds, when issued, moreover, and in the hands of citizens of Baltimore, are actually subjected to a tax by the state and city, amounting together to nearly one per cent.; an impression also generally prevails, that they would be liable to the same tax in the hands of citizens of other states, and it is certain that it would be competent for the authorities, either of the state or city, not only to create this liability, but to increase the tax according to the exigencies of either. These causes combined, have hitherto effectually prevented the sale of the bonds, unless at a sacrifice which the Board did not feel authorized to incur without every effort in its power to avoid.

The first difficulty the Board have already removed, by executing and directing to be recorded a mortgage of the property, effects, and revenue of the Company, second only to the mortgage already existing for the security of the million loan, on account of the Washington road, and by limiting the amount included in the mortgage to $1,000,000, and the application of that amount to the re-construction of the road, and the reimbursement of $58,182·64, applied during the past year to the increase of power and machinery for the coal trade.

That this measure alone will add to their value, and render the bonds more saleable, is not to be doubted; and that their exemption from tax by the state and city, would establish them at par, and perhaps enable them to be sold at a premium, is believed to be equally clear.

The cheapening of the cost of transportation, the diminution in the expenses of working and repairs, and the consequent increase of the nett revenue resulting from the reconstruction of the road, would, under any circumstances, be considered as much more than an equivalent to the city or the state for the loss of any revenue they could hope to derive from a tax upon the Company's bonds.

It is, however, only proper to remark, that not only the contracts already made in regard to the thirty miles of the road, but the early reconstruction of the entire line between Baltimore and Harper's Ferry, is not a matter of discretion, but of necessity, to be accomplished in no other way, and by no other means, than the use of the annual revenue, or by the sale of the Company's bonds at the best prices that may be obtained. In this view, that an exemption of the bonds, not exceeding one million of dollars, from taxation by the state and city, would be preferable to the sacrifice of a depreciated sale, or the loss of an annual dividend until the present engagements can be complied with, and the re-construction of the road completed, it is supposed will not be questioned by any one.

After fully weighing the foregoing considerations, the Board have felt it their duty not to incur the responsibility of producing either of the losses, or any of the inconveniences already pointed out.

They have determined, therefore, to reimburse so much of the revenue of the year as has been applied to the coal trade and to the reconstruction of the road, by the issue of the six per cent. bonds secured by the mortgage already recorded, and in preference to a sacrifice of the bonds in the market at the present prices, to pay them to the stockholders, to be used as they may deem proper.

Pursuant to these views, the Board having applied $20,000 to the sinking fund on account of the loan for the Washington road according to the pledge contained in the annual report of 1842, have declared a dividend of three per cent., or three dollars per share, payable as follows, that is to say: to all stockholders owning on the first day of the present month less than fifty shares of stock, three dollars in money on each share on and after the 20th day of November next; and to all stockholders owning on the said first day of the present month fifty shares and over, one dollar on each share in money, and two dollars in the bonds of the company, bearing six per cent. interest payable quarterly, and reimbursable in twenty years; the money to be paid and the bonds to be delivered on or after the said 20th day of November next.

By this measure, all the stockholders will receive back in undoubted securities the full amount borrowed from the revenue and applied to purposes of capital; and to those who may desire to invest their dividends, an advantageous opportunity of doing so is thereby afforded. It is hoped and believed that the partial payment of money will render it unnecessary for any to dispose of the bonds until further measures can be adopted to increase their value; and to the state and city especially, ample opportunity will be afforded, by authorizing a just exemption of the bonds from taxation, not only to raise to their full value those now to be paid on account of the dividend, but to insure the reception of an annual dividend of the profits of the road in future.

While announcing these measures, however, the Board deem it not less due to the stockholders, than an act of justice to those to be in future associated in the management of the Company, to point the attention of the stockholders *to the actual and probable state of the*

Company's affairs, during and at the termination of the year commencing with the first of the present month.

The Board, therefore, proceed to state that, on account of the contracts for the re-construction of the thirty miles of road, already explained, there will remain to be paid before the first of March next, not less than $225,000;—on account of new locomotive engines constructing under contracts executed in the months of April and May last, and payable during the same period, $70,000;—for new burthen cars now under construction, $20,000; and for improvements at the several depots, $10,000.

To these must be added the interest upon the bonds now directed to be delivered to the stockholders, and upon such temporary loans as it may be necessary to make in anticipation of the revenue, and also the installment payable during the year to Messrs. Baring, Brothers, & Co., of London, estimated together at $93,000—and forming an aggregate of existing engagements of not less than $418,000.

It will be perceived, therefore, that, independent of contingent expenses, such as rarely fail to occur in the course of a twelvemonth's operations, the revenue of the current year, if it should equal that of the past, will be absorbed by debts already incurred; and, consequently, that without disposing of the Company's bonds to meet the contracts for re-construction, it will not be in the power of the Board to make any dividend at the end of the year.

It is also to be observed, that an amount of not less than $335,000, arising out of these existing engagements, must be paid before the first of March next, and not improbably obliging the Board to dispose of a considerable amount of their bonds without regard to the state of the market; in which case it would be necessary to add the loss sustained by a depreciated sale, to the other charges upon the revenue of the year, as already explained.

It is proper, also, in this place to state, that during the last session of the Pennsylvania legislature, a law was obtained authorizing the construction of a railroad from Pittsburg to some point on the Maryland line, where it might be united with the Baltimore and Ohio railroad; and, in the expectation that it might thereby become an important *lateral* connexion of their road with the Ohio river, the Board, in the month of May last, authorized a subscription to be made on behalf of this Company for 700 shares, costing, at the par value, $35,000, in case such amount should be found necessary to secure the charter of the Pennsylvania Company. Seven hundred shares were accordingly subscribed under the authority so given; and the first installment, amounting to $1750, was paid out of the revenue of the Baltimore and Ohio Railroad Company.

It is now understood that the Pittsburg and Connellsville Railroad Company are desirous of progressing with their road with the least possible delay, and that they are not without expectations of further and greater assistance from this Company. Whatever may be the result of these expectations, it is certain that a compliance with the subscription already made will be insisted upon, and the extent to which this Company may be called upon for payment, will be an ad-

dition to the obligations, already explained, to be discharged from such resources as may be in its power.

It would seem, therefore, that without a considerable increase in the business of the road, or a like diminution in the expense of working it, and unless the Board should be enabled to dispose of the bonds, proposed to be issued, at fair prices, it is not only probable, but certain, that there can be no dividend at the end of the current year, but that the nett profits, and consequently the dividend, of the year ending September 30th, 1848, will also be materially diminished.

II.—*Of the Washington Road.*—The affairs of the Washington road are shown by the statements E and F.

These statements show an improvement in the business, and an increase in the revenue during the last half year, as compared with the preceding six months.

The nett profits, including the surplus of $6888·31 after the dividend in April last, amount to the sum of $60,576·70; of which the Board have declared a dividend among the stockholders of three dollars upon each share of stock for the last six months, payable on and after the fifteenth day of the present month, and leaving a surplus of $11,076·70, to be carried to the account of the current year.

III.—*Of the further Prosecution of the Road to the Ohio River.*—Important as a judicious and economical management of the existing work may be, and necessary as it undoubtedly is, by all the means at their command to develope and extend its present resources, the Board continue to regard the early prosecution and final completion of the road to the western waters, as their great and ultimate duty.

Considered in reference to the magnitude of the enterprize, or to the effects which may be expected from its judicious location and successful completion, the Baltimore and Ohio railroad is inferior to no work of internal improvement in this or any other country. That a short and cheap route between the states of the middle and southern valleys of the Ohio and Mississippi, and the Atlantic markets, may be found by a line from Baltimore to more than one point on the Ohio river, is not to be doubted; and, it is equally clear, that a route to which a preference is ultimately to be given, must be, in a great degree, determined by its connexions with the western country.

The line which will be the most desirable and afford the greatest facilities to the largest portion of the population of the Ohio and Mississippi valleys, and maintain the most successful competition with rival works seeking the same object, ought to be preferred by all; and, in this view, important as the work may be to Baltimore, it is not likely to be estimated less by all the states on the Ohio and Mississippi valleys. By consulting the interests of those states, their co-operation may be reasonably invoked, and time and the developments constantly in progress may be expected, at no remote day, to triumph over all the obstacles which have hitherto retarded the enterprize.

The recent legislation of Pennsylvania, referred to in another part of this report, if used with proper skill and energy by those in charge of the work it authorizes, may insure to the Company, independent

of all other legislation, the opportunity of connecting their work with the Western States, if not at the best, certainly at a point possessing great advantages; and if it be not allowed to defeat the prosecution of the Baltimore and Ohio railroad *to its legitimate termination at a more southern point on the Ohio*, will deserve and ought to receive every reasonable encouragement from this Company and from the people of Baltimore. The Board, at the same time, without meaning to underrate the importance of the railroad from Pittsburg to the Maryland line, are unwilling to lose sight of the expectation that by means of the legislation of the State of Virginia, they may yet be enabled to prosecute the main stem of their road to some eligible point on the Ohio river within that state.

It is not probable that the just claims of the people of the north-western and south-western counties will be much longer neglected by the enlightened councils of that great commonwealth; and it is not unreasonable to expect that other interests, heretofore more partial to other improvements, will, at no distant day, be brought to look upon the Baltimore and Ohio railroad as the most practicable means of developing the resources of those parts of the State which have hitherto depended upon other means.

The proceedings of a numerous convention of delegates from the north-western counties of the State of Virginia, recently held at Weston, Lewis county, would appear to encourage these expectations, and to warrant the hope that so much intelligence and perseverance cannot fail ultimately to succeed.

Nor do the Board deem it unreasonable, at a period when the utmost exertions are every where making to unfetter the trade and facilitate the intercourse between different communities, to count upon the cordial co-operation of the Western States, and of the most distant parts of the Union, in support of an enterprize affording to all the easiest access to the best markets.

To no portion of the United States are works of internal improvement of greater importance, than to the states south and east of the Ohio river; and it is not to be supposed, that the people of those states will long remain insensible to this truth. Already the introduction of steam upon the western waters, has accelerated the advance of that immense region beyond that of older parts of the Union, and little remains to complete their prosperity than such means of inter-communication with the Atlantic States as, with the application of steam upon their great rivers, will unite the employment of the same power upon land.

It will be the duty of the Board, therefore, to appeal to those interests, and, by all the means in their power, endeavor to render them auxiliary to the prosecution of the great work they have in charge.

By order of the Board,

LOUIS MCLANE, *President.*

Baltimore, October 12, 1846.

(To be continued.)

The Gauge Commission.

Analysis of Evidence given before the Royal Commissioners appointed to investigate the subject of the diversity of Railway gauges.

Continued from Vol. XII Page 366.

John Urpeth Rastrick, Esq.:—The largest engine on the London and Brighton railway is one of 15-inch cylinder. Gives a preference to the cross over the longitudinal sleeper, as it is much more easily rectified and kept in order. At the time the extension of the Greenwich railway (that is, the widening out of it where the Croydon, Dover, and Brighton railways run over it,) was proposed to be done, the Directors of the Greenwich Railway Company desired their engineers (Colonel Landmann and Mr. Miller,) to make a report upon the sort of rails they ought to use in the laying down of those two lines. Each of those gentlemen made out a report; one recommended rails to be laid of the same size as those that are laid on the Croydon railway, which is a rail that has got a flat top to it; it is rather a low rail, with a wide flanch at the bottom, and a narrow rib between the top and the flanch, and that was to be laid on longitudinal bearers. The other gentlemen recommended that the rails should be made about 75 pounds per yard, (these are called the H rails,) and fixed in cast iron chairs with wooden keys. The Directors of the Greenwich Railway Company did not think proper to take upon themselves to decide which of those rails should be laid down, and they sent the reports that had been made to them, to witness (of course not putting the names of the engineers to the reports, but merely stating that they were the reports of their engineers), and requested an opinion as to which of these methods they ought to adopt. Advised them to adopt neither of the rails, as the Croydon rail seemed (that is the light rail, and the light longitudinal bearer,) altogether too weak, and the other was not so well adapted for a viaduct as it would be if laid on longitudinal bearers, but a stronger rail; therefore recommended them, instead of making use of a cross sleeper, with a 75 lb. rail, to make use of a bridge rail of 80 lb. per yard, which had got a wide flanch at the bottom. The rail was about 2¾ inches wide at the top. The flanch was half-an-inch thick, and the outside width of the flanch was six inches, and each of those sides was three-quarters thick; these rails were screwed to the timber; screw pins went through the longitudinal timbers, and underneath these were bars into which the screw-pins were screwed. By placing an auger-spanner on the top of the pins, the rails can be screwed down most securely. The rail laid down on the viaduct of the Brighton Railway was found to answer so well that witness recommended its adoption to the Greenwich Railway, and those rails are now laid down there. The nut keeps its hold and will run back, because it can at any time be screwed up; they have nothing to do but to apply an auger-spanner on it. Is laying down a railway from Hastings to Lewes, and likewise from the Chichester line, from Shoreham to Chichester, with rails of that description, but on cross bearers with this addition, that to each of them,

at the joints, there is a wrought-iron plate into which the two rails slip. There is a wrought-iron plate about 10 inches long, turned up on the edges, so as to form grooves; the two rails come together into this wrought-iron plate; the rails cannot separate, and of course that part which turns down on the upper flanch of the rail keeps the one rail from rising above the other. In laying down these rails on the Greenwich Railway, we had no provision of that sort, and consequently they are liable in some degree to rise one above the other, unless the screws are kept tight: but even if the screws are all slack where these wrought-iron joint plates are used, they cannot rise one above the other. The rails were laid on cross sleepers; did not use the screw-pins at all, but merely a parallel bolt five-eighths of an inch in diameter, which holds better than screws or any other contrivance. We bore a hole half an inch in diameter, and then drive in the bolt: in fact, they hold so very fast, that in endeavoring to get them out sometimes on the Brighton Railway when a chair has broken, we have had to bend the pin backwards and forwards considerably before we could pull it out.

The velocity of the express trains on the Brighton is about 34 miles an hour, with one stoppage at Red Hill. There is very little oscillation if the road is in good order. Outside cylinders do not produce any yawing motion, it is impossible any such motion can be produced, unless there is a play in the framing itself. Considers the outside cylinders to be very much preferable to the inside, and they run a great deal steadier.

Mr. Henry Pringle Bruyeres: Is superintendent of the London and Birmingham Railway, and controls the general arrangements both of passengers and goods. Average speed of express trains on London and Birmingham line between station and station, exclusive of stoppages, rather more than 40 miles an hour, making no allowance for slacking and regaining speed. Including the stoppages at stations, the speed is 37 miles an hour. Does not think the greatest speed at any time exceeds 45 miles an hour for any distance. Passenger carriages on London and Birmingham line greatly improved. The improvement in the first class carriages is, as respects the construction, making the under framework stronger, and making it solid instead of open, as it was originally; in point of comfort to the passengers, in making the carriages larger altogether; each compartment being longer, to give more room for the legs, and higher. The carriages the company now build are in size proportionate to those on the Great Western Railway, with the exception that they may be three or four inches less in height. The reason of having them less in height is to allow of the luggage being conveyed on the roof; however, ample room is given, even for a tall person with his hat on inside. The luggage placed upon the tops of the carriages is principally "through" luggage, belonging to passengers that are going a long distance, so that when they arrive at the end of their journey, instead of having to seek their luggage at the forward part of the train, it is over their heads, and if they can only divest themselves of the idea that they are in a crowd upon their arrival, and remain stationary on getting out of

the carriage, they will find their luggage immediately before them. All inside cylinders, and only one six-wheeled engine. The Company are now building six-wheeled engines. The engine and tender are tightly screwed together. Probable expense of London and Birmingham goods wagons into loose boxes for transfer on to broad gauge about, £50 per wagon. The London and Birmingham line now so consolidated, that the rains have little effect upon it; subsidence of the ballast does not take place upon the embankments.

The area of the Rugby Station is about 12 acres, including the portion used by the Midland Railway, as well as the London and Birmingham.

Dimensions of old and of new carriages.—They consist of three compartments, holding six persons each; the old carriage was in length, that is between the persons, face to face, 4 feet 11; the new are 5 feet 9, being an increase of 10 inches; the width of the old carriage was 6 feet, and the new is 6 feet 6, giving 2 inches more in width to each seat. The height of the old carriage was 5 feet, and the new ones are 5 feet 7, giving an extra height of 7 inches, that is between the floor and the ceiling, and taking it at the centre of the ceiling: the roof is curved about two inches, and is 5 feet 5 at the two sides. The outside length of the old carriages was 15 feet 6, and of the new are 17 feet 6. That is the entire body. The width was 6 feet 6 in the old, and is 7 feet in the new. The height, allowing for the curve mentioned before, would be 5 feet 2 the old, and 5 feet 8 the new. The total height above the rail of the top of the carriage is 8 feet 9 the old, and 8 feet 10 the new. The additional height inside has been obtained by lowering the floor.

At present, if the Great Western Company reqnire engines from the North of England, when not carried by water, they come up upon the London and Birmingham, and are transferred from Euston-square to Paddington, and run down the Great Western line. This has frequently been the case; they are brought up on trucks. The comparative dead and nett weight carried by the down express train for the month of August, 1845, is as follows: number of passengers, 1613; carriages, including luggage van, 132; weight of passengers at ten to a ton, 161 tons: weight of carriages, 556 tons.

Colonel George Landmann: Was engineer of the London and Greenwich Railway and the projector of that scheme. When the line was constructed, used a very light rail, of 50 pounds to the yard. Subsequently changed those rails for others of a heavier description, weighing 85 pounds; the first rails did not reverse; the present rails do reverse; the new part is upon the Great Western principle, upon longitudinal sleepers; in the first instance, used stone blocks, which were afterwards changed to transverse sleepers. The widened portion of the line, from London to the separation of the Croydon, and the portion from Deptford to Greenwich, originally laid upon longitudinal sleepers, with the same form of rail as the Great Western; that rail was 50 pounds to the yard, whilst the Great Western was 43 pounds. The longitudinal sleepers between Deptford and Greenwich are 12 inches wide by 6½ deep; those upon the widened part

are the whole size of the baulk; 12 and 13 inches, with ties across the same depth, to preserve the gauge. The longitudinal sleepers of the Greenwich line, extending from Deptford to Greenwich, rest upon transverse sleepers, 10 inches by 6, by 6 to 7 feet long, and placed at distances of about 4 feet apart, and to which the longitudinal sleepers are spiked; these sleepers were all Kyanized, and, as far as witness has been able to discover, are still quite sound. With longitudinal sleepers a lighter rail might be used than would be required where there is a space between the supports; and if the ground be properly made at first under longitudinal sleepers, is of opinion that that would be the best mode of constructing a line; objects to the mode adopted under Mr. Rastrick's direction of laying the rails upon the widened portion of the Greenwich Railway. Witness's design was to have transverse sleepers, with the longitudinal sleepers upon them; it now entirely rests bedded upon earth; if it had had fixed points to rest upon, it would have been much more secure. Should rely entirely upon the bearing upon the transverse sleepers. It is not found too elastic upon the Great Western; the longitudinal sleeper is only 7 inches thick; they have no transverse sleepers. The engines on the Greenwich line weigh about 14 tons with the water. Some are six and some are four-wheeled engines; four-wheeled engines are going out of use as fast as they become destroyed; upon a portion of the line (the Brighton and South Eastern line) they run with much heavier engines, weighing 16 or 17 tons.

Charles Vignoles, Esq.: Laid out the Eastern Counties with Mr. Braithwaite, but that gentleman executed it; a question as to the gauge arose; was then very desirous of making the gauge wide; Mr. Braithwaite's view of having a 5-feet gauge was adopted; should have preferred a 6-feet gauge. Intended the Dublin and Kingstown Railway to have been a 6-feet gauge; but the Directors overruled his opinion, on the plea that so short a line might, if necessary, have its gauge altered without inconvenience; they had to obtain all their first carriages and engines from England, where 4 feet 8½ was the prevailing gauge, and they were very unwilling to depart from it: he has been consulted in laying out many principal lines, and also on the gauges of many; the Edinburgh and Glasgow was laid out, though not executed, by him; as it was likely to connect ultimately with lines coming from the south, on the 4 feet 8½ principle, that gauge was adopted; some Scotch lines already executed are on rather a narrow gauge; thinks one coal line, the Forfar, was 5 feet 6 inches; but the general feeling was strong that connexion with south lines should be kept in view; most of the lines mentioned were previously to the introduction of the broad gauge by Mr. Brunel. On the Continent, as the engines and carriages were obtained from England, they were unwilling to deviate from the fixed rule; the first railway in Brunswick was about 30 miles to the foot of the Hartz mountains, and the English gauge was adopted; the latest large operation of his on the Continent was laying out the Wirtemburg railways; there the question of gauge was greatly discussed, and is not yet settled; they are intended to unite the railways in Baden, which run parallel to the

Rhine, and those in Bavaria, which run from the Danube; the gauge of the Baden railways is 5 feet, or 5 feet 6, and that of the Bavarian 4 feet 8½; under all the circumstances, he recommended that 4 feet 8½ should be adopted; as all the railways in connexion with Bavaria, and all the Saxon and Austrian, are 4 feet 8½, and as a great transit trade was coming from those countries, he considered that the larger amount of traffic would be from those of 4 feet 8½, and that the length of rail on the Baden side, next the Rhine, would be short in comparison; he thought Baden would ultimately be obliged to change, and bring it to the gauge of the others on the Continent; however, Baden and Bavaria persist in not changing, and it is a question at what point the transit shall take place, whether on the eastern or western frontiers of Wirtemburg; thinks the probability is, that they will ultimately adopt the 4 feet 8½ gauge throughout Wirtemburg.

As to the cost of the carriage frame, thinks it would increase as the squares of the gauges, but with a certain additional amount of accommodation; one great advantage of a large carriage is, that you get less gross weight in proportion to the nett; does not know whether that has been realized in practice, but thinks it ought to be so. As regards increase of speed, does not think on that alone the Great Western has an advantage; the trains travel very fast on it, but much more is due to the gradients, which are very flat, than to the gauge; with respect to economy of working, the expense on the Great Western and the London and Birmingham is as near as possible the same. With respect to safety, as far as it is connected with steadiness, is quite satisfied that at very high velocities the trains travel more steadily on the Great Western than on the London and Birmingham, taking the gradients as they occur. In the abstract, is quite satisfied there is greater steadiness of motion on the broad gauge at high velocities. If the road happens to be out of order, or the springs of a carriage stiff, or if it is not loaded or over loaded, or a little slack in the coupling up, or too tight —all those will affect it particularly at high velocities; has not made a series of experiments, but is quite satisfied that it is steadier with the broad than with the narrow gauge at a high velocity. It is impossible to write on the London and Birmingham at a high speed; he could read in their express trains very well where the road was in good order, but when bad could not.

Used to be, and is still, very partial to the longitudinal sleeper; but some facts have come to his knowledge to shake his views, in particular, on a foggy morning on the North Union, when an engine comes to the longitudinal sleepers she invariably slips, which does not take place on the cross-sleepers; cannot account for it. It may be owing to a dampness that remains on the longitudinal sleepers which may impart to the rail a moisture which converts dust to mud, and produces greasiness. The soil is chiefly sand, with probably a little clay in that portion of it; but still, wherever the longitudinal sleepers are, the engine has a great tendency to slip. Has often calculated the relative cost of laying rails on the longitudinal and cross-sleepers; it was very much in favor of the longitudinal in the first instance, where a slighter baulk was used; but as it is now necessary to have the whole

or at all events a three-quarter baulk, the balance is against the longitudinal as the more expensive; a very heavy rail, with a cross-sleeper without the chair, answers very well, and is the most economical mode. The first Liverpool and Manchester rails were 35 lb., and the 42 lb. rail on the Dublin and Kingstown is still in use. On the lower part of the North Union the 42 lb. rails have been taken up and replaced by 63 lb. On that line the passenger trains are light, but the merchandize and coal excessively heavy. The lengths of bearings are 3 feet 9 inches and 4 feet; four to a rail.

Should the Grand Junction Company alter to the broad gauge, it would be practicable to alter the North Union too, as the bridges and tunnels are sufficient for the purpose; none of the bridges are less than 30 feet span, and those of the Great Western are not more. His practice is to make bridges about 30 feet. The tunnels are about 27 feet.

On the Midland Counties the bridges are all 30 feet; the viaduct at Rugby is 27, which would admit of the broad gauge by corbelling out the parapet; the Great Ribbie Bridge on the North Union is 27 or 28 feet wide, and the tunnel into Preston, the only one, is nearly 30 feet. With less than 30 feet there would not be room for a man with safety; it would be better to have recesses built in the tunnels. Thinks, by a judicious system of transfer of bodies, the packing and unpacking at Gloucester might be avoided. The passenger carriage-bodies may be transferred, as at Rouen, to the frame of the railway carriage, without any risk or difficulty. Has ridden in one of those carriages, and been lifted up with it, without any practical inconvenience. It is bolted down, and is as perfect as if it were the railway carriage itself. A carriage put together in that way is as strong as a usual one, in case of collision; it is strong enough to be lifted, and, being required for the road, is stronger than the railway carriage. Considers the 7-feet gauge wider than is necessary; the wider the gauge, the more the effects of curve are felt; does not think the gradient at all enters into the question. The Great Western has large driving-wheels, not with regard to gauge, but velocity; there is no necessary connexion between the diameter of the wheel and the gauge. Would not adopt the 7-feet wheel on the narrow gauge; but that is a proof that it must be steadier on the broad. A great number of things were proposed in adopting the broad gauge, which have not yet been carried out with effect. Were he the engineer of a broad gauge line, should avail himself of the increased space to make engines more powerful. The necessity of increasing the engines is every day apparent, and to have engines so far above the work that there can be no question about their power. The driving-wheel of the engine will regulate the velocity; one of the Great Western engines, with the large driving-wheel, would give the same amount of speed, whether on the broad or the narrow gauge. The diameter of the driving-wheel is quite a different question from that of gauge, except as regards the increased steadiness arising from the wider gauge.

(To be continued.)

Cost of Railways in Great Britain.

The following is the average cost per mile of some of the principal lines in this country :—

Arbroath and Forfar,	£9,214	London and S.-Western,	£28,004
Chester and Birkenhead,	34,198	Manchester, Bolton & Bury	70,000
Dublin and Drogheda,	15,652	Manchester & Birmingham	61,024
Dublin and Kingstown,	59,122	Manchester and Leeds,	64,582
Dundee and Arbroath,	8,570	Midland,	30,949
Durham and Sunderland,	14,281	Newcastle, Darlington, and Brandling,	22,992
Edinburgh and Glasgow,	35,024	Newcastle and Carlisle,	17,837
Eastern Counties & North-Eastern,	46,355	Newcastle and N. Shields,	44,233
Glasgow, Kilmarnock, and Ayr,	20,607	Norfolk,	13,150
Glasgow and Greenock,	35,451	North Union and Bolton & Preston,	27,799
Gravesend and Rochester,	13,333	Preston and Wyre,	22,261
Great Western,	43,885	Sheffield and Manchester,	48,543
Hartlepool,	26,600	South-Eastern,	44,412
London and Birmingham,	38,400	Taff-Vale,	21,610
London and Blackwall,	287,678	Ulster,	14,334
London and Brighton,	56,981	York and N. Midland, &c.,	25,924
London and Croydon,	80,400		

Min. Jour.

Government Engineers in France.

The corps of engineers of Ponts et Chausses, (roads, bridges and public works,) now on Full pay in France, consist of 9 inspectors-general, 23 divisionary inspectors, 213 chief engineers 387, ordinary ditto, 66 candidate engineers, and 27 students of the first class—making 722, to which may be added 109 engineers of mines—making 831.

Ibid.

Reason for the original adoption of the usual Gauge for Railways.

While we are on the subject of the gauges, we may be permitted to mention a fact or two. It is not, as has been asserted, an arbitrary and random measure which was taken for the gauge of railways. The breadth of the gauge, as Mr. George Stephenson admitted to us some time ago, when we mentioned it to him, was taken from the breadth of the wheels of carriages on common roads. A breadth of five feet from the outside of the bottom of one wheel to that of the other, was the standard breadth for carriages on turnpike-roads, and that had been determined from long experience as the best breadth for easy draught to horses. In some parts of the kingdom there was, indeed, a rather narrower, as we have observed in the lower parts of Devonshire; but, generally, five feet was admitted to be the standard.

We have been assured, that wider wheels produced a sensibly heavier draught, while, from circumstances of convenience and comfort to the horses, they could not well have a narrower. One reason why they should all have the same breadth doubtless was, that the wheels should be able to keep in the same ruts—a measure of consequence heretofore, when the roads were bad and worn into tracks.

Lond. Railway Mag.

Railway Bills.

The following is an account of all railway bills which have been reported to the House of Commons during the present session, with a statement of the ***maximum*** rates of charges and fares for goods and passengers, respectively authorized by such bills. The document contains 138 bills, made up to the 29th of May. From an examination, it appears that, in the first class the highest sum to be charged per mile for passengers is to be 3½d., and the lowest in the same class 2d.; whilst in the third class the charge is to be 1d. and 1½d. In the second class the charge in some instances is to be 1½d., and in others 2d. a mile. On some of the railways, when the speed is more than 25 miles per hour, an additional ½d. is allowed in the first class. The charges in some of the bills, reported during the present session, are to have reference to former acts. In the Great Western bill, no provision has been made with regard to charges of any description.

Min. Jour.

Cornish Engines.

The number of pumping engines reported this month is 29. They have consumed 2271 tons of coal: and lifted 24 million tons of water 10 fathoms high. The average duty of the whole is, therefore, 53,000,000 lbs., lifted one foot high by the consumption of a bushel of coal. Average consumption per horse power per hour, 4·011 lbs.—"*Lean's Engine Reporter*," *July 15th.*

AMERICAN PATENTS.

List of American Patents which issued in the month of December, 1845,—with Exemplifications, by CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

1. For an *Improvement in the Water Ram for raising water;* Erastus W. Ellsworth, East Windsor, Connecticut, December 6.

Claim.—"What I claim as my invention and desire to secure by letters patent, consists in a peculiar manner of working the water ram in combination with the syphon, by the use of a chamber of rarified air, for the purpose of causing the escape-water to flow down the

longer leg of the syphon in a continuous stream; also, in the use of channels in the packing of the joints, supplied with water from the air vessel of the ram, for the purpose of excluding, completely and with certainty, the external air from the syphon; also, in the fixtures herein described for the setting in motion and regulating the quantity of water consumed by the ram."

This is an improvement on Montgolfier's water ram, the nature of which is sufficiently apparent to need no further exemplification.

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2. For an *Improvement in Pressing Glass in Moulds;* Joseph Magoun, East Cambridge, Massachusetts, December 6.

Claim.—"Having thus explained my invention, I shall claim the plate as combined with the sliding frame for the purpose of receiving the cap plate of any mould of various moulds, as described; also the making the whole frame, plate, toggles, lever, and bars, and rest block of the toggles, adjustable with respect to the mould or bed plates upon which it is placed, in the manner as above described."

The plate (M) is the bed of the press, so formed and connected with the slide of the follower of the press as to admit of the introduction and removal of any mould, that various moulds may be used in succession. The moulds have a flanch at the top, which rests on the bed plate (M.)

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3. For *Improvements in the Portable Cooking Furnace;* C. L. H. Webb, Lockport, New York, December 6.

Claim.—"I claim the quadrangular, inverted, pyramidal form of the grate in combination with the side doors, hinged at the bottom and opening downwards, to answer the purpose of hearths, that the whole surface of the fire at the sides may be presented, and the rays therefrom may be cast on to instead of over the article to be cooked or heated on the hearths, as herein described. And, finally, I claim the method of sustaining the side doors when open, by means of the jointed and sliding links, as herein described."

The doors are prevented from falling by being connected with the case by means of a joint and slide link. This link is jointed at one end with the door, and the other is provided with a long slot which slides on a stud pin projecting from the case, so that in closing the door the long slot slides on the stud pin, and when the door is open to a horizontal position the end of the slot rests against the stud pin.

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4. For an *Improvement in Cooking Stoves;* Samuel Pierce, Peekskill, New York, December 6.

Claim.—"I claim the arrangement of the parts by which I supply the fire with heated air; said arrangement consisting mainly of the sliding register and the plate in front of which the air must descend on its passage to the grate bars. The heating of the admitted air has been attempted under other arrangements, and I limit my claim in

this particular, therefore, to the special combination of parts by which I attain this end."

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5. For *Improvements in the Corn Sheller;* Thomas D. Burrall, Geneva, New York, December 6.

Claim.—"In the machine described, I claim making the *concave plate or disk* with a concave face and circular opening, provided with a lever and upper lip for the discharge of the cobs, in combination with the sheller and with the shell or bottom, and also the door or valve in the side for the broken cobs, &c.; and also the cylindrical *hopper and spring in combination with the feeder,* as herein described."

In this machine, the corn is shelled by teeth on the face of an iron disk, which works against a concave plate so curved as to form a spout at the top for the discharge of the cobs; the shelled corn being discharged at the bottom. There is a hole in the back plate with a valve for the discharge of broken cobs which are not carried out of the spout. The hopper is cylindrical, and provided with a spring which presses the cobs against the teeth of the feeding wheel, by which the ears are delivered regularly to the sheller.

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6. For an *Improvement in the Furnace for heating air;* Ebenezer Barrows, New York, December 11.

Claim.—"Having thus fully described the nature of my improvements in the air-heating furnace, what I claim therein as new and desire to secure by letters patent, is combining with such a furnace the evaporating and radiating vessels or vessel M, arranged, combined, and operating substantially in the manner and for the purpose herein made known."

This furnace is combined with an evaporating apparatus which supplies to the heated air the required quantity of moisture. The pipe which conducts off the gaseous products of combustion is connected with branch pipes which carry these hot gases to chambers surrounding the vessel (M) to evaporate water contained in them, and from these chambers the draught is conducted to the chimney. By means of a damper, the draught from the furnace can be carried around these vessels, or directly out. The vapor thus generated mingles and circulates with the heated air from the furnace.

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7. For *Improvements in the Cotton Gin;* Theodore Ely, New York, December 11.

The patentee says:—"Much difficulty has been experienced in ginning the long staple cotton, from the tendency of cutting or breaking and heating the fibres, results so injurious to the staple—the value of which depends on the length and entirely and perfectly natural condition of the fibres. The most general mode which has been resorted to for the effectual ginning of the long staple cotton is the use of rollers, which draw the fibres and separate them from the

seeds. These rollers have been made of various substances, such as metal, wood, cork, stone, &c., with their surfaces smooth, fluted, indented, &c.; but all these, so far as I am informed, have failed in giving satisfactory results. Those made of wood have so far been the most successful, but in a very short time they become rough, and injure the staple; and have, therefore, frequently to be renewed. And even these only succeed when the cotton is fed in by the hand of an attendant, who, with his fingers, properly loosens and distributes the pods. The metal rollers, in consequence of the smoothness of metal surfaces have to be fluted, or otherwise indented, that they may take sufficient hold of the fibres to draw them through, and as these, thus formed, tend at times to draw in too much cotton at once, together with the seeds, the two rollers must be pressed together by extra force, such as weights or springs, which additional pressure tends to heat the rollers, and thus to injure the staple Rollers made of other substances have, for like and other causes not necessary to enumerate, failed to produce the results anticipated and required.

"All the kinds of rollers which have been used tend to 'lap the cotton,' as it is termed, that is, the fibres adhere to and are wound around the rollers. These defects in the operation of roller gins arise from the fact that the cotton is not properly loosened preparatory to being submitted to the action of the rollers, and because these (the rollers) have not been made so as to avoid heating and griping the fibres, and from their arrangement and action on each other the surfaces which act on the fibres are so brought together as necessarily to injure each other. The object of my improvements is to avoid all these defects, and they consist in the following devices, viz:—in the employment of a toothed roller which takes the cotton from a feeding board or apron, and carries it around, properly distributed, to the action of a rotating beater, which whips it, and loosens the pods, and blows them in regular quantities down an inclined board to the bight of the two separating or ginning rollers, which are made slightly fluted or grooved in lines parallel with their axes, the better to catch and hold the fibres; but to prevent the bad tendency which has always been experienced in the use of fluted metallic rollers, the flutes or grooves do not extend their whole length, the ends being left perfectly smooth for a short distance, so that the edges of the flutes of the one shall not enter the recesses of the other, or catch and cut the fibres, this being prevented by the smooth surfaces at the ends, which roll on each other. And the tendency to cut, and tear, and injure the fibres by the heating of the rollers is also avoided, by dispensing with the additional pressure, heretofore used, so long as the proper quantity of cotton is presented to the action of the rollers, and these do not draw in too much; but when this does take place, then their bearings, or the sliding boxes in which they work, are brought into contact with weighted levers, springs, or other analogous device, properly gauged, to bring them into action before the rollers shall have been sufficiently separated to permit the entrance of seeds. The rollers are relieved of this additional pressure the moment the overcharge of cotton ceases, for then the weighted levers or springs are arrested by the gauges.

"And the lapping of the cotton around the rollers is avoided by means of additional rollers, placed in front of, and in contact with, the ginning rollers; the surfaces of the two sets, where they come in contact with each other, moving in opposite directions, to strip the ginning rollers of any fibres which may have a tendency to adhere to them.

"These improvements I have effectually tested by a long series of experiments, and the cotton is not only ginned with greater rapidity, but the fibres are delivered in as perfect a condition as if separated by hand."

Claim.—"What I claim as my invention and desire to secure by letters patent, is making the ends of the fluted, grooved, or ridged ginning rollers, without the flutes, grooves, or ridges, so that they shall run on each other, and thus prevent the injurious action of their parts operating on each other and on the fibres of the cotton, as described.

"I claim the rotating, stripping, or cleaning rollers, in combination with the ginning rollers, for the purpose and in the manner substantially as herein described.

"I also claim the feeding roller and beater or blower, in combination with the ginning rollers, for the purpose of loosening the cotton, and presenting it to the action of the ginning rollers, as described.

"And, finally, I claim the beater or blower, in combination with the ginning rollers, for the purpose and in the manner described."

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8. For *Improvements in the Furnace for heating apartments;* Henry Kalussowski and J. P. Wierzbicki, New York, December 11.

Claim.—"Having thus fully described the manner in which we construct and arrange the various parts of our apparatus for heating apartments, and shown the operation of the same, what we claim therein as new, and desire to secure by letters patent, is the manner of combining and arranging the radiating air heaters so that the air to be heated by them shall ascend on both sides of them, or shell, or case, or casing of brickwork, performing the same office, as set forth; and the fire-place above the top-plate being so enclosed by a suitable plate, or by masonry, as to cause the whole of the air heated by the radiators to pass into the apartment, in the manner described.

"We do not claim the use of a radiator or radiators, like those described, as new, such having been before used; but we limit our claim to that arrangement of them by which they are made to heat an ascending current of air on each of their sides, for the purpose herein fully made known.

"We do not intend, however, by this claim, to limit ourselves to the particular form of either of the parts of the said apparatus, but to vary these as we may think proper, whilst we attain the same ends by an arrangement of parts substantially the same."

9. For a method of *Combining Canals and Railroads;* Samuel S. Walley, Charlestown, Pennsylvania, December 11.

Claim.—"Having thus fully described the manner in which I combine the railway and canal for the purpose of transportation, what I claim therein as new, and desire to secure by letters patent, is the combining of a railroad and canal by laying rails on the bottom of the canal which is to be used, and the rails submerged in its content of water; by the employment of a locomotive engine and of car-boats, which, whilst their wheels are sustained upon the rails, are to be buoyed up by the water, as set forth.

"I claim the adapting of the car-boats and the lock chamber to each other, so that when the former are contained within the latter they shall operate as lock gates by preventing, or nearly preventing, the passage of water, thereby allowing the lock gates to be opened and the train to pass through the lock with little loss of water, upon the principle and substantially in the manner herein described."

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10. For an *Improvement in the method of Constructing the Sails of Vessels;* James Maull, Philadelphia, Pennsylvania, December 11.

Claim.—"What I claim as my invention and desire to secure by letters patent, is cutting and making the sails of all kinds of vessels with the warp of the cloth and the seams in a horizontal direction, for the purpose and in the manner described."

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11. For a *Filter for Inkstands;* Walter Hunt, New York, December 11.

Claim.—"My claims in the above described invention are confined to the filter tube, in combination with the funnel, plunger, spring, and perforated bottom, arranged substantially in the manner and for the purposes described."

The filter tube extends from the funnel-shaped ink tube at the top to within a short distance of the bottom, to permit the ink to rise through a hole in a cork at the bottom. Above this cork, the ink has to filter through a sponge to supply the chamber above. The lower end of the funnel-shaped ink tube is provided with a small funnel-shaped piece, which is forced up by a spiral spring, and provided with an aperture filled with sponge. When the pen is dipped, the part last described is borne down to admit ink from the filter tube, the sponge in the dipping tube permitting the ink to flow back, at the same time excluding the air.

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12. For an *Improvement in Gates for Fences, &c.;* Andrew Hood, New York, December 16.

The patentee says:—"The principle of my invention consists in hanging a swinging gate on a central axis when combined with a fence arranged around it, with a carriage or other way on opposite sides, so that the gate closes against either side of these gateways

the gateways being open on each side for the admission of carriages, horses, &c., within the fence. And also in providing the gate with projecting handles, for operating two latches or bolts which fasten it, so that the rider in passing along can reach the handle and turn the gate against the other side of the carriage way without the necessity of dismounting, as is the case in the present mode of construction."

Claim.—"I do not claim as my invention hanging a gate on a central axis, so as to open in either direction and close without a return movement, as this has long since been effected; but what I claim as my invention and desire to secure by letters patent, is such a gate hung and turned on a central axis in combination with the fence arranged around the axis of the gate, and provided with two carriage or other ways on opposite sides, as herein described, and for the purpose specified."

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13. For an *Improvement in the Power Loom;* Robert P. Cunningham, Abington, Connecticut, December 16.

In this loom, the two shuttle cams are so formed as to move back the pickers as the shuttle approaches them, for the purpose of gradually arresting it; and to adapt this mode of making the cams to looms that have sliding shuttle-boxes to change the colors, the cams are made with a slight depression to draw back the pickers from the ends of the shuttle, that the shuttle-boxes may be shifted without the shuttles hanging on to the pickers."

Claim.—"What I claim as my invention and desire to secure by letters patent, is forming the face of the shuttle cams with a depression, as herein described, to permit the picker to be moved back clear of the shuttle point, after the shuttle has been arrested, and before the shuttle boxes are shifted, as herein described."

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14. For an *Improvement in the Bathing Apparatus;* Wm. G. Young, assigned to A. H. Reiss, Baltimore, Maryland, December 16.

Claim.—"Having described my improvement, what I claim as my invention, and desire to secure by letters patent, is a boiler surrounding a furnace, as herein described, in combination with a flue ascending and returning in an apartment at the foot of the bath, as set forth."

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15. For an *Improvement in the Apparatus for the Manufacture of Sugar;* Francis Duplessis, Plaquemines, Louisiana, December 16.

Claim.—"I am aware that, for cooking and other purposes, kettles have been set directly into a steam boiler, so as to have the steam in the boiler act directly against their bottoms, but this has always been limited to one kettle for each boiler, which, if applied to the manufacture of sugar, would require one boiler for each kettle in the series, presenting not only the objection of great cost in the original construction, but much labor in attendance, as well as the important difficulty of keeping up an equal temperature under all the kettles at the

same time, which is frequently required; and, therefore, I do not wish to claim simply letting a single kettle into a steam boiler, to have the steam act directly on the bottom thereof, nor do I wish to claim simply the insertion of a series of kettles in one boiler for general uses; but what I do claim as my invention and desire to secure by letters patent, is the arrangement of a series of kettles for evaporating saccharine juices and sirups in the manufacture of sugar, on the top of, and let into, one steam boiler, when any method is employed of regulating the temperature of the kettles—that is, reducing or increasing the temperature of a portion of the series without affecting the rest—substantially as described.

"I also claim arranging the series of evaporating kettles, let into the top of one steam boiler, to have them exposed directly to the action of steam within the boiler, in combination with the arrangement for heating the pans, for preparing the saccharine juice, by means of steam conducted from the boiler into the double bottoms of the pans, as described.

"And I also claim dividing the boiler into two or more compartments by a partition or partitions, provided with a valve, in combination with the arrangement of kettles let into the boiler, for the purpose of regulating the temperature, as described."

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16. For an *Improvement in Cooking Ranges;* Wm. Beebe, New York, December 16.

Claim.—"I do not claim to have invented the mode of causing a circulation of water between a principal boiler or water back and the boiler by the pipes, as this is in common use; neither do I claim to have invented the arrangement or application of the pipes to the circulation of hot water within a building, except as hereinafter stated; but I do claim as new, and of my own invention—

"1st. I do not claim to have invented or introduced the pipe to lead in the supply of water from any competent head, but I do claim the mode described of forming this pipe with perforations or orifices near the boiler head, for the purpose of securing the boiler against accidental injury, in the manner and with the effects described and set forth.

"2d. I do not claim to have invented the hollow plug of the cock, but I do claim the mode of making and fitting the said plug with the short slots, to draw hot water by the bib, in combination with the long slot, at right angles with the two former, for the purpose of maintaining a circulation of hot water in the pipes, or suspending the same by turning the blank part of the plug to the pipes, substantially as the same are described and shown."

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17. For an *Improvement in Water Tables for Doors;* A. S. Pelton, Clinton, Connecticut, December 16.

Claim.—"Having thus fully set forth the manner in which I arrange and operate a water table or weather strip at the bottoms of doors,

what I claim therein as new, and desire to secure by letters patent, is the particular manner in which I have combined the respective parts, as described; that is to say, the water table being forced down by the action of the head of the rod on the inclined plane, through the intervention of the levers, and being raised by the spiral springs when the door is opened; and the necessary adjustments being also effected by the aid of the screw nuts and spiral springs, substantially in the manner described."

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18. For a method of *Restoring the Fullness or Roundness to the Cheeks;* John Allen, Cincinnati, Ohio, December 16.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the manner of restoring hollow cheeks to their natural contour and rotundity by means of metallic bulbs, formed, fitted to, and secured in the mouth, substantially in the manner set forth, or by any other attachment between the jaw-bones and the cheek."

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10. For an *Improvement in the method of Manufacturing Chewing Tobacco;* Henry Moore, Reedsville, North Carolina, December 16.

The patentee says, "Instead of pressing the lumps of tobacco in formers, as generally practised, I lay or pile the leaves of tobacco one above another, on a bed of wood or metal, and within a movable frame which surrounds the bed—the fine covering leaves being placed at top and bottom; then the frame is removed, and another frame put on top of the tobacco, and the whole submitted to the action of a powerful press, by which the whole mass of tobacco is pressed and divided into any required number of 'lumps,' and the covering leaves drawn tight and smooth over the surface."

Claim.—"What I claim as new, and desire to secure by letters patent, is the method of forming tobacco 'lumps' by means of the frame and series of blades, arranged and formed substantially as herein described, in combination with the bed, whereby I save much labor in arranging the tobacco leaves, &c., and I am enabled to form and press a large number of 'lumps' at one operation, to lay the covering smooth and even, give a more perfect form, and discharge them from the moulds in which they have been formed with greater facility than by the old method."

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20. For an *Improvement in the method of attaching Printing Types to a Cylinder;* Richard Hemming, Boston, Massachusetts, December 16.

The patentee says,—"This invention consists simply in making the types with a recess in one face of the body or shank, to receive a rule, or strip of metal, which is laid in after a whole range of types has been set up; the ends of the rule projecting beyond the range sufficiently to be secured by a slide or cap plate attached to the cylinder. From

this it will be obvious that no one type can rise above the range without cutting off the rule, a number of them cannot rise in a curve without bending the rule, and the whole range cannot rise because the ends of the rule for each range are held down by the slides or cap plates."

Claim.—"What I claim as my invention and desire to secure by letters patent, is the method of retaining types in their proper relative positions on a cylindrical bed by means of rules or strips of metal, or other appropriate substance, fitting into recesses made for that purpose in the body or stem of types, substantially in the manner described."

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21. For *Improvements in Fire Engines;* Ernest Marx, New York, December 20.

The object is to use the hind wheels of the carriage as fly wheels to the engine when at work by lifting the back part of the engine so as to relieve the wheels; but the claim is drawn up in such manner that it cannot be understood without the drawings.

The first section of the claim is limited to the arrangement of parts for lifting the hind part of the carriage and chocking the front wheels, and the second section is limited to the arrangement and combination of parts for connecting the working parts of the engine with the hind wheels to make them operate as fly wheels.

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22. For *Improvements in the Steam Engine;* John Ericsson, New York, December 20.

In this there are two engines connected with, and operating a crank shaft with the cranks at right angles. The steam is admitted directly from the boiler to only one of the cylinders, and when the piston in this has made half its stroke the communication with the boiler is closed, and a communication with the other cylinder opened, that the steam may act expansively in both, driving the two pistons in the same direction, until the piston in the first cylinder has completed its stroke, then the communication between the two is closed, that the steam in the second may continue to operate by expansion while the piston in the first makes its return half stroke by the force of steam directly from the boiler like that above described on the other side. The two engines are on the condensing principle.

The exhaust pipe of the first engine communicates with a heater as well as with a condenser, and this pipe is provided with a valve which establishes a momentary communication between the cylinder and the heater, and when this connexion is closed the steam passes to the condenser.

Claim.—"I do not claim as my invention the pistons, valves, or any other known part of the engine, hereinbefore described, nor do I claim the passing the steam from one cylinder to another, that having been done by Wolf, and others; but I claim as my invention, and desire to secure by letters patent, the connecting the pistons of the two cylin-

ders to cranks placed at right angles, in combination with the admitting the steam directly from the boiler into one cylinder only, and the working of the steam expansively in said cylinder, together with the employing the steam to act simultaneously on both pistons during half the stroke as herein described, by opening a communication alternately, and keeping the same open during only half the stroke between the two cylinders, whilst at all times a vacuum is kept up during the entire stroke in both cylinders, on the opposite sides of each of the pistons to that on which the steam acts."

"And I also claim as my invention the momentary stoppage of the exhaust pipe of that cylinder, which receives the steam from the boiler into a receiver partially filled with tubes, through which the feed-water is passed on its way to the boiler, in the manner hereinbefore described."

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23. For an *Improvement in Magnetic Telegraphs;* Ezra Cornell, Ithica, New York, December 20.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the new and improved mode, described, of arranging and adjusting metallic wires, or other conductors to electro-magnetic and galvanic telegraph instruments, by which instruments, at opposite extremities of the same, or of a single main wire, or located at distant points on the same main wire, or a single wire, may be kept in constant readiness for use, in conjunction with a galvanic battery, without the necessity of keeping the galvanic circuit closed, or the battery in action, when neither instrument is at work; and by which the battery is put out of action instantly on the ceasing of the motion of the instrument, and in like manner is put into action immediately on commencing the motion of an instrument, and avoiding the disadvantage heretofore experienced in what have been denominated *dependent* circuits, in the working of two or more telegraphic instruments over a single circuit of wire, or of wire and earth conjoined."

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24. For an *Improvement in Riveting Pipes made of Sheet metal;* Jonathan Ball, New York, December 20.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the mode of holding the rivets in the holes by the use of the springs, in combination with the mandrel or the clamps, in the construction and application, as they are set forth in the accompanying specifications and drawings."

The metal is bent, having the two edges which are to lap some distance apart. The rivets are inserted in the holes, along one edge and held there by small clip springs. The pipe is then placed between two clamps and over a mandrel so as to have the heads of the rivets resting on it; the clamp is then closed which brings the holes on the other edge of the sheet over the rivets ready for the hammer of the workman—the spring clips having been removed before closing the clamps.

25. For *Improvements in the Cultivator;* Allen Eldred, Oppenheim, New York, December 20.

The patentee says, — "My invention consists in connecting the ploughs with the frame by means of iron sockets secured to the side of the side and centre pieces; and in jointing these sockets to the frame for the purpose of regulating the set of the ploughs to cut deeper or shallower; and in securing the front double tooth to the frame by inserting it in a mortise of sufficient length to receive a wedge front and back, projections being made on each side of the standard, that lie in recesses made for that purpose in the under face of the centre piece of the frame to act as journals, so that by driving the wedges front or back, the point of the double tooth may be elevated or depressed to cut deeper or shallower."

Claim.—"What I claim as my invention and desire to secure by letters patent, is jointing the sockets that receive the standards of the ploughs to the frame, as herein described, to admit of adjusting in a vertical as well as horizontal direction, as specified; and finally, I claim the method of adjusting the front double tooth by means of the enlarged mortise and wedges, in combination with journal projections on the standards, as described."

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26. For *Improvements in Machinery for working Ivory Comb Plates;* Calvin B. Rogers, Saybrook, Connecticut, December 20.

We are under the necessity of omitting the claims as they are wholly dependent on the drawings.

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27. For an *Improved Iron Truss for Ships;* John W. Wilson, Philadelphia, Pennsylvania, December 20.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the *relief truss*, attached to the truss hoop connecting it with the mast, to the arm, connecting it with the lever and the yard so as to permit the topmast to be lowered and raised any time at pleasure, through the relief truss, without unshipping the yard, or in anywise interfering with its motions, actions, uses, or any of its appurtenances."

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28. For an *Improvement in the machine for Double Seaming Tin Ware:* Daniel Newton, Louisville, Kentucky, December 20.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the turning of a double seam on the bottom of tin and copper ware, by the application of a bevel wheel on a shaft placed at right angles with the shaft on which the vessel revolves, in combination with the guide on which the same rests, in order to insure a perfect rotary motion of the vessel."

The article to be double seamed, is placed on a wheel at the end of a horizontal shaft, and guided and retained on it by a guide standard, and the double seaming is effected by a bevel wheel on a vertical stud

pin, the bevel part of the wheel acting in connexion with the edge of the wheel that carries the article to make the seam.

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29. For a *Machine for Beating and Cleaning Wire;* John J. Howe, Derby, Connecticut, December 26.

Claim.—"I claim as my invention, and wish to secure by letters patent, the combination, herein described, of parts which are designated herein, and marked in the drawings respectively, as follows, viz: the block or platform, the lifter, and the curb or pins 1 and 2; and I claim said combinations of the block, lifter, and curb, whether in combination with or without the guide."

The platform is a bed with a hole in the centre, and excavations to receive the spindle hub and radial bars of a lifter on which the wire is to be placed. This lifter is carried up gradually by a cam and then permitted to fall, to give the required jar or blow to the wire, which is retained on the lifter by a series of vertical rods projecting from the platform.—The lifter may receive a slight rotary motion by a guide.

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30. For an *Improvement in the Machine for Turning Oar Handles;* Ezekiel Page, Barcelona, New York, December 26.

Claim.—"I therefore claim the said inclined rail and slide, as combined with the opening of the puppet head, the same being for the object as above set forth."

The inclined rail is permanent, and is for the purpose of giving the swell to the oar handle by acting on a slide rest, in a sliding puppet head, to reduce the opening through which the oar handle passes for the purpose of giving it the required form, the cutter which turns the handle being placed in the upper part of the hole, so that as the slide rest is elevated by the inclined rail, the space between the rest and cutter shall be reduced.

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31. For *Improvements in the Camphine Lamp;* James Maclean, Philadelphia, Pennsylvania, December 26.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the use or substitution of tubes made of a material which is a non-conductor of heat, instead of the ordinary metallic tube, between which the wick works up and down, and also the protection of the non-conducting tubes by the cap or prolongation in metal.

"I do not claim any particular form of lamp, but simply the application of tubes of a non-conductng material, and the protection of such tubes from the effects of the flame of the lamp. The tubes in question may be applied to lamps of every shape and construction, and my claim is intended to cover such application."

The prolongation referred to in the above claim is the extension of

the outer metallic tube above the upper end of the non-conducting tubes, for the purpose of protection. The object of substituting non-conducting substances such as wood, china, &c., for the metallic tubes heretofore used, is to prevent the too great evaporation of the oil, and the drying of the wick, which induces the deposite of resinous matter, thereby impairing the capillary action, &c.

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32. For an *Improvement in the Instrument for Cutting Coats, called the "Coat Sector;"* Allen Ward, Baltimore, Maryland, December 26.

The patentee says,—"My coat sector consists mainly of four arms, and of a flexible neck slide, two of the arms lie in a straight line with, and slide upon each other, and might in fact be denominated a sliding arm; but as this sliding arm consists of two pieces, I have denominated them, each piece, as an arm."

Claim.—"Having thus fully described the manner in which I construct my coat sector, and also that in which it is applied to the marking out for cutting a coat, what I claim therein as new, and desire to secure by letters patent, is the manner in which I have arranged and combined the four arms and the neck slide; the respective arms forming the angles herein designated, or nearly such, and the second and third arms being made to slide upon each other, for the purpose of enlarging or diminishing the profile of the garment to be cut; there being also, on three of those arms, divisions, with marks or numbers corresponding with each other in their general proportion and arrangement, as represented in the drawing, and herein fully described. I will here remark that, although the divisions and numbers marked on the respective arms are considered as useful and convenient for despatch, they are not essential, as the measure taken as herein designated may be applied to the arm, and a mark be made upon it the length of the combined arms. B and C may also be determined by the same measure, and the neck slide also be moved thereby to its proper place, these three measures always being about the same.

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33. For an *Improvement in the Method of Raising Spring Water;* Benjamin S. Benton, Harford, Maryland, December 26, ante-dated August 5, 1845.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the raising spring water to a higher level than its source by the momentum of a running stream of river or other water in contact therewith, in a double ram, constructed as aforesaid, or other ram, constructed and combined substantially in the manner set forth, by which analogous results are produced—the two rams being united by an additional pipe, in which the spring and river water come in contact, as above set forth.

"I also claim the combinations and arrangement of the lever, bucket, and valve, with reservoir, as described, for keeping up the

action of the machine. I likewise claim the arrangement of the spring for insuring the opening of the valve, as described."

There is a vessel, containing the water to be employed in raising the spring water, that communicates with one ram, and this, by another pipe, communicates with a second ram, which, in turn, communicates, by a pipe, with the reservoir of spring water to be raised. The first ram has a waste pipe and puppet valve, and the second has an air vessel with a valve interposed between the main chamber and the air vessel, and another valve at the end of the pipe that leads from the fresh water reservoir into the chamber of the ram. When the puppet valve of the first ram is opened by a lever, the water from the two reservoirs rushes to and out of the waste pipe, until the momentum is such as to close the valve, and then the propelling water from a greater head than the spring water causes it to return into the second ram, and into the air vessel thereof; at the same time closing the valve in the pipe leading to the fresh water reservoir; this impulse forces the fresh water up through a small pipe leading from the air vessel, to the required height. The return pulsation, &c., takes place as in the common water ram.

For the purpose of keeping the river water at the required height in the reservoir, and to stop the flow when not high enough, there is a spout in the reservoir which discharges water into a bucket on one end of a lever, the other being provided with a valve which closes the pipe that leads to the first ram. The bucket has a small hole in the bottom for the discharge of water, so that when the water in the reservoir is below the required level the water runs out of the bucket, and when empty, the valve end of the lever preponderates, to close the valve and stop the machine, but when the water rises sufficiently to flow over into the bucket faster than it can run out, then the valve is opened, and the operation goes on.

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34. For *Improvements in the Machine for Bolting Flour;* Robert C. Mauck, Honeyville, Virginia, December 26.

Claim.—"Having thus fully described the nature of my improvements in the flouring mill, what I claim therein as new and desire to secure by letters patent, is the manner in which I have arranged the flights around the bolting reel, in combination with the arrangement of the respective spouts HH and I, and with a device for altering the inclination of the bolting chest and reel, for the purpose set forth."

The flights are strips of wood placed diagonally on longitudinal bars on the periphery of the bolting reel, and their object is to force the flour in the inclined trough to a series of discharge spouts (HH,) which lead to an elevator, to be re-transferred to the bolting reel, and these spouts are provided with valves, that any of them may be closed at pleasure, to regulate the quality of the flour which is to be discharged through the upper spout (I.) The lower end of the trough is suspended to a strap, so that it can be raised by a drum.

35. For an *Improvement in Cast Iron Railroad Wheels;* George W. Eddy, Waterford, New York, December 26.

Claim.—"I do not claim the manner of constructing a cast iron or metal railway car wheel, by making it of two convex or concave plates, or one convex and one concave plate, united to a solid or divided hub, and a circular rim and flanch, as heretofore made; but that which I do claim, is my improved manner of constructing a wheel, by which I am enabled to cast it with a solid hub, and in other respects as I have above set forth, viz: by making it with an *undulating* plate, in combination with a concave or convex plate, or another undulating plate, as herein described."

The undulating plate, referred to in the claim, is formed with concentric waves or undulations, which, when the metal shrinks in cooling, will straighten out a little, and thus prevent the metal from breaking.

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36. For *Improvements in the Tubular Steam Boiler;* James Montgomery, Memphis, Tennessee, December 26.

Claim.—"Having thus fully described the nature of my improvement in the steam engine boiler, and shown the operation of the same, what I claim as new therein, and desire to secure by letters patent, is arranging the fire chamber or furnace of a tubular boiler at the side, so that the heat shall act on the upper half of the tubes, in combination with a diaphragm or partition and flue to carry off the flame, heated air, &c., to act on the lower half of the tubes, after acting on the upper half, as described.

"And I also claim the making of the bottom of the boiler of a conical or dished form, with a mud or blow-off valve in the lowest part of the concavity, in combination with the vertical tubes communicating with the bottom, in the manner herein described, to permit the deposite of the sediment, there being a water space surrounding them to induce circulation of the water up the tubes and down the surrounding space, to wash the sediment towards the mud or blow-off valve, as herein described."

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37. For *Improvements in the Water Wheel;* John Mecay, Millsborough, Pennsylvania, December 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the combining with the spiral scroll the projecting portion of the buckets, marked X in the drawing; and in combination with the foregoing I claim the arrangement of the buckets, substantially as described and set forth."

The case that surrounds the wheel is a scroll that gradually approaches the periphery of the wheel, so as to cause the water to pass into the wheel and to be discharged therefrom around the shaft. The buckets are eccentric from the inner to the outer periphery of the rim of the wheel, and that part which projects beyond the rim, and into the case, and designated in the claim by the letter X, is curved in the reverse direction.

38. For a *Composition Cement for Covering Roofs, &c.;* Wm. Y. Singleton, Springfield, Illinois, December 26.

Claim.—"What I claim as my discovery, and desire to secure by letters patent, is the before described composition of lime, sand and charcoal, forming a cement that is impervious to water; that is to say- I claim to have discovered the use of charcoal and stone coal as a component part of plaster or cement, by which it is rendered impervious to water."

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39. For an *Improvement in Grist Mills;* Josiah Platt, Bridgeport, Connecticut, December 26.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the suspension of the upper stone by being firmly fastened to a flanch, connected with a hollow spindle through which the mill is fed, said hollow spindle having groovings around its circumference, near each end, fitting the edges of corresponding friction wheels arranged around said spindle, and the arrangement of the segment bar, all in connexion and combination, as aforesaid."

The runner is attached to a hollow spindle, which is suspended, not by journals, but by the peripheries of friction rollers and segment bars—their peripheries being formed to run in corresponding grooves in the spindle.

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40. For an *Improvement in the Mill for Grinding Bark;* Amos Lindsey, Canton, Maine, December 26.

Claim.—"What I claim as my improvement, and for which I ask an exclusive right, is my mode of combining and applying two or more cylinders of circular saws, as above described, viz: by alternating large and small saws, and applying them to each other so that a large and small saw shall be opposite, and cut against each other."

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41. For *Improvements in the Truss;* Lorenzo D. Fleming, Newark, New Jersey, December 31.

Claim.—"What I claim as new in the above described instrument, is the construction of *pockets* in combination with an abdominal *spring pad*, with descending lobes, by which it may be easily adapted to nearly all cases of inguinal hernia, securing a decided advantage over the common truss, by being much easier to the wearer, suiting it to double hernia, and preventing a rupture on the opposite side, which often occurs by wearing the single truss.

"I also claim the employment of *rings* to be slipped into the *pockets* of the *front pad*, for encircling the ruptured spot, in order to contract and excite the muscle, thereby disposing the part to heal. The rings may be made of any shape, diameter, or width, that the form or nature of the rupture may require. The instrument I call '*Dr. Fleming's spring pad supporter and truss.*'"

42. For an *Improved Process for Preserving Potatoes;* Charles S. Edwards, Rushville, Illinois, December 31.

Claim.—"Having thus described the nature of my invention and the best manner I am at present acquainted with for performing the same, I would have it understood that I make no claim to any of the apparatus herein described; nor do I confine myself thereto, although I consider the means above described the most simple and best for performing the invention.

"But what I claim as my invention, is the mode of preserving potatoes in a cooked, or partially cooked state, by means of obtaining the substance of potatoes in a separated or finely divided and dried state, as described."

The process is as follows:—The potatoes, after being washed and boiled until the skins show symptoms of cracking, are skinned and properly stripped of eyes, &c. The potatoes are then formed into fine threads like vermicelli, by being forced through small holes in a cylinder, and then dried on tables exposed to a temperature varying from 100 to 160 Fahrenheit.

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43. For an *Improvement in Cooking Stoves;* Samuel Myres, Schenectady, New York, December 31.

Claim.—"I do not claim the supplying the oven with heated air, by means of a flue in contact with the fire chamber; but I do claim the peculiar construction and particular arrangement of the flue in combination with the chamber and pipes, as I have arranged them in my stove, for conveying heated air through the oven, for the purpose of heating the upper part thereof, as described."

The flue is triangular, and lies in the bottom of the fire chamber, receives air from outside the stove which is heated in passing through, and thence discharged into a chamber between the fire chamber and oven, and from this chamber the heated air passes through vertical pipes placed in the horizontal flue, to the upper part of the large oven, and when mixed with the gases generated in the oven, passes off together through a pipe into the main flue of the stove.

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44. For an *Improvement in Reed Musical Instruments;* Nathan B. Jewett, Worcester, Massachusetts, December 31.

Claim.—"I therefore claim the disk upon the extremity of the lip of the reed, in combination with a corresponding enlargement of the air passage of the reed plate as described.

"Also, bending the stem of the reed at an angle with the lip, and also so bending the same, and in the form of an inverted U; the whole being substantially as above explained."

This is intended for the purpose of improving the tone of the reed and tuning it with more facility. The back part of the reed is attached to the sound board above its surface, so as to have the tuning slide above and below. The reed is then turned up like an inverted U, and then runs horizontally with an enlargement at the end, which alone receives the action of the current of air.

45. For an *Improvement in the Bee Hive;* James Robb, Lewistown, Pennsylvania, December 31.

This claim refers to and is wholly dependent on the drawings, and we are therefore under the necessity of omitting it. It is limited to the peculiar manner of constructing and arranging a sliding and, a vibrating trap for crushing the moth when attracted by the warmth under these traps.

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46. For an *Improvement in the Pulp Strainer for the Manufacture of Paper;* Wm. Bishop, Coventry, Connecticut, December 31.

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the mode of clearing pulp, to be used in the manufacture of paper, from sand, gravel, metallic and other hard and injurious substances, by means of the above described pulp-sand strainer."

This strainer consists of a box with a series of round bars placed near together and on the same plane, so that the pulp in flowing over the bars will flow in undulations which tend to deposite the impurities between the bars and in the box below.

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47. For an *Improved mode of Ascending Inclined Planes on Rail Roads;* Ezra Coleman, Philadelphia, Pennsylvania, December 31.

The locomotive is provided with an endless screw with its axis parallel with the rails, which can be connected with the driving or crank axle, for the purpose of drawing the load up inclined planes by having the threads of the screw take into cogs, made of friction rollers, on a rack placed between the two rails, the driving axle being provided with loose running wheels alongside of the drivers, for the purpose of raising the drivers from the rails when the screw acts on the cogs.

Claim.—"Having thus fully described the nature and operation of my invention, what I claim as new therein, and desire to secure by letters patent, is the placing an independent set of bearing wheels within the frame of the locomotive, revolving loosely upon the main driving shaft, and adapted to an inner extra track of rails, (raised above the main track,) for the purpose of sustaining the weight of the locomotive in ascending or descending inclined planes, lifting the driving wheels from the main track of the rails, and rendering the action of the driving shaft independent of the bearing or driving wheels, when it is desired to transfer the whole power of the locomotive steam engines from the driving wheels to the endless screw, geared to the driving shaft, and its thread working into a rack of friction rollers; the whole arranged, combined, and operating substantially in the manner and for the purpose herein set forth."

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48. For an *Improvement in the Bee Hive;* Aaron Colton, Pittsfield, Vermont, December 31.

Claim.—"Having thus fully described the construction and operation of my improved bee-hive, what I claim as new therein, and desire to secure by letters patent, is the manner in which the honey or

lateral boxes are arranged, in combination with a pyramidal central hive, constructed and operating substantially in the manner and for the purpose set forth."

The honey boxes are placed one above the other on each side, but gradually approaching the middle of the hive, that is to say, the second range of boxes are so much nearer the centre as to have a portion of their bottom project sufficiently into the hive as to leave an entrance at the bottom for the bees, and so of the other ranges.

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49. For an *Improvement in the Refrigerator;* Joseph T. Craddock, Baltimore, Maryland, December 31.

The nature of this improvement consists in so combining a filter for filtering the water, with a refrigerator that the water when drawn off from the refrigerator shall be supplied from the filter and consume no more ice than is required to cool the quantity of water required for use

Claim.—"What I claim as my invention, and desire to secure by letters patent, is the filter, arranged substantially as described, in combination with the cooling chamber surrounding the ice chamber, located and arranged substantially in the manner and for the purpose specified."

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50. For an *Improvement in the method of Mounting the Booms of Vessels;* James Davis, Jr., Gloucester, Massachusetts. December 31.

Claim.—"The main feature in my said new and improved boom saddle and jaws, which I claim as my invention, and desire to secure by letters patent, is the following, reference being had to the description and drawings, viz: The method of constructing a saddle so as to leave a space between the mast and the saddle, in connexion or combination with the insertion of the slide or slides in the jaws of the boom."

The jaws of the boom are cut out towards the mast to receive slide pieces, which will turn when either end of the boom moves without the other, so that their bearing surface against the mast will always lie fair to avoid bighting.

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51. For *Improvements in the Manufacture of Nails, Pins, Screw blanks, Rivets, &c.;* Samuel G. Reynolds, Bristol, Rhode Island, December 31.

Claim.—"Having now described the construction of the improved machinery to be employed in the manufacture of nails, rivets, screws, and pins, I desire to be understood that I claim, in reference to the heading of metal rods or wire for the above purposes, the means of effecting what I call a "double upset," viz: by crushing the end of the rod or wire for forming the boss or head of the nail, rivet, screw or pin, by two or more operations of a single heading-punch and pair or set of holding dies and the sliding guides, the whole in combination as described; the rod or wire being brought forward between the holding dies a short distance by the sliding guides, after the first or

partial crushing of the metal has been effected, in order to supply a sufficient additional quantity of metal to complete and perfect the form of the boss or head when the second pressure of the punch is brought up against it. As respects the pointing of pins, and discharging them from the machine, I claim my improvement therein; the same consisting in imparting to the sliding-bar certain alternating, lateral, and back movements in its bearings, as described, whereby the pins are turned in opposite directions during the action of the mill-roller upon them, and discharged from the machine when the pointing of them has been completed."

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52. For an *Improved Apparatus for applying Medicated Baths;* Benjamin Sweet, Mount Morris, New York, December 31.

Claim.—"What I claim as my invention is the mode, herein described, of applying medicated vapors; that is, by submitting the body or parts thereof to the vapor of the substance used, without the presence of steam, by means substantially the same as herein set forth."

The vapor is generated in the outer casing of a double cased stove, the outer space of which communicates with a box in which the patient sits with his head out, the top of the case being fitted to his neck.

List of American Patents which issued in the month of April, 1842, *with Exemplifications, by* CHARLES M. KELLER, *late Chief Examiner of Patents in the U. S. Patent Office.*

(Continued from vol. xii, page 154.)

26. For *Improvements in the Plough;* George Watts, Gainesville, Alabama, April 11.

The beam instead of being connected with the standard by tenon and mortise, is attached to the side of the standard by a staple, (called a "cuff" in the specification,) which embraces the beam and passes through the standard, and is then secured by nuts. The coulter is in like manner secured to the beam, to avoid weakening the beam by perforations.

Claim.—"What I claim as my invention, and which I desire to secure by letters patent, is the mode of fastening the beam to the side of the standard by means of the cuff embracing the beam and passing through the standard, by which arrangement the beam is not weakened by perforations for the usual bolt fastenings or tenonings, and likewise the beam is rendered adjustable, in the manner and for the purpose above described.

"I also claim the method of attaching and bracing the coulter to the beam, by means of cuffs embracing the beam, in the manner described, instead of being bolted through the beam, as heretofore."

27. For *Improvements in Machinery for Cutting Shoe Soles;* Elias T. Ingalls, Haverhill, Massachusetts, April 11.

The knives that cut the two sides of the sole, (leaving the heel and toe to be trimmed,) are each attached to a separate block, and the two blocks are connected together with screws, to admit of adjusting the cutters on the die to different sizes. This constitutes the subject of the first claim; but the second claim we are under the necessity of omitting, as it is wholly dependent on the drawings. It is limited to the combination of parts by which the position of the leather is regulated for each cut.

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28. For *Improvements in Heating Buildings;* Reuben Mitchell, Portland, Maine, April 11.

In this furnace and fire-place there are two fire-chambers, for the objects and in the manner pointed out in the following

Claim.—"Having thus described my improvements, I shall claim arranging a hot-air chamber, beneath the hearth of the fire-place, or between said hearth and the ash chamber under the same, and in combination therewith depressing the fire-pot or furnace below the level of the hearth or into the hot-air chamber, the same being constructed substantially as hereinbefore described, and for the purpose before mentioned.

"Also, constructing the upper fire-place with sliding doors, by which it may be closed, and forming an opening in its rear, and a damper in the main flue, above said opening; by which arrangement, the smoke and other heated products of combustion may be caused to circulate through the fire-place (and flues of the same,) of the room, and to impart heat, substantially as described. Also, separating the lower fire-place from the hot-air chamber below it, for the purpose described, by means of a plate or slab, as set forth."

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29. For an improved *Compound for Promoting the Growth of Hair;* Vair Clirehugh, New York, April 11.

Claim.—"What I claim as new and desire to secure by letters patent, is the combining together of alcohol, of the active principle of cantharides, and of iodine, substantially in the manner and for the purpose set forth. I also claim the further combination of muriate of ammonia and of castor oil, or either of them, with the first named compound of alcohol, cantharides, and iodine; the respective ingredients being employed in the proportions designated and made known."

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30. For an *Improvement in the Process of Tanning Leather;* Joseph Southwick, Boston, Massachusetts, April 11.

Instead of the usual process of handling hides, this patent is granted for placing them in a trough, in which they are to undergo the operation of pounding, or filling in the tanning liquor.

Claim.—"Having thus described my improvements in the process of tanning by machinery, suspending the necessity of 'handling' the hides or skins, (for the purpose of producing uniformity of color,) and impregnating or infusing into the same the tannin, or essence of the astringent solution, by subjecting them to the action of the vibrating beaters in the tannin trough, or the fulling process above described, the whole arrangement and operation being substantially as above set forth."

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31. For *Improvements in Machinery for applying Paste or Sizing to the Surface of Sheets of Paper, for making Cards or Pasteboards;* David H. Gilbert, Dorchester, Massachusetts, April 11.

Claim.—"Having thus described my improved machinery, I shall claim applying paste or adhesive matters to sheets of paper or other material, by drawing said sheets by a sliding carriage frame between two cylindrical or suitable brushes, revolving or moving in contiguity with each other, all substantially as above set forth; also, the combination of said carriage frame with the table, and also with the movable apron for the purpose of depositing the pasted sheets of paper in a regular pile upon said table, the said combined machinery being constructed and operated substantially as described.

"I further claim the machinery for freeing or separating the sheet of paper from the finger-bar and carriage, so that said sheet may fall upon the table; the said machinery consisting of the plate with its rods extending rearward therefrom, the weighted shaft with its projecting arms, and the stud of the table; the same being arranged, combined together, and operating substantially as herein described."

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32. For an *Improvement in Window Shutters, called the "Window Guard;"* Arthur L. Johnson, Baltimore, Maryland, April 11.

Claim.—"I do not claim to have invented a 'window guard,' or shutter, consisting of slats joined together, as this has long since been done; but what I do claim as my invention and desire to secure by letters patent, is the making the ends of the slats in the various forms herein described, to fit into grooves in the frame, substantially as herein described, whereby to prevent the slats from being drawn out should they be separated from each other by violence, and also for the purpose of preventing the paint from being chafed off of the guard, in the operation of rolling up, as herein described."

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33. For an *Improvement in the Cotton Press;* P. G. Gardiner, New York, April 16.

Claim.—"It is to be understood that I do not claim the attaching of a curved rack or toothed segment to one of the arms of that kind of progressive lever usually denominated the toggle joint, and the combining therewith a toothed pinion, by means of which, said levers shall be actuated; but what I do claim as new, and desire to secure

by letters patent, is the particular manner in which I have arranged and combined the toothed segment, the pinion, and the toggle joint, as above set forth, the curved segment being attached to, and extending from end to end of the upper arm of the progressive levers, and having the requisite eccentricity to enable the pinion to operate upon it, under an arrangement of parts substantially the same with that herein fully described; and I also claim, as a modification of said arrangement, the substitution of chains or bands for the toothed gearing, such chains or bands passing over a plain segment, and being operated upon by a shaft, around which they wind, this latter answering the purpose of the toothed pinion, the principle of action being the same in either case."

34. For an *Improvement in the Air-heating Stove for Warming Buildings;* Salvin F. Kellogg, Norwalk, Ohio, April 16.

Claim.—"Having thus fully described the construction of my air-heating stove, and shown the manner in which the same operates, I do hereby declare that I do not claim the conducting of cold air into an air-heater, nor the subsequent conveying of the air so heated to distant apartments, this having been previously effected, and by means of apparatus constructed in a variety of ways; but I limit my claim to the particular manner herein described, in which I have combined and arranged the stove, the air-heating chambers or flues, and the boilers with their appendages, as above set forth; that is to say, I claim the manner of forming the air-heating chamber or flue, and of arranging it within the stove, so as to occupy the whole width thereof, and to have its upper and lower plates, and its sides, exposed to the direct action of the fire, or to that of the heated air immediately escaping therefrom. I also claim the manner of combining the boilers, the heated air pipe, and the smoke pipe, by tubes leading into each, the respective parts being governed by valves, in the manner and for the purpose above set forth."

35. For an *Improvement in Ploughs;* Thomas Wiard, Avon, New York, April 11.

This patent is granted for an arrangement of parts for uniting the share, mould-board, and land-side, by certain overlapping joints. We omit the claim, as it could not be understood without drawings.

36. For *Improvements in Furnaces and in the manner of applying Heat to the Manufacture of Iron, &c.;* C. E. Detmold, of New York, assignee of W. Von Faber du Four, of Wirtemburg, April 16, 1842; granted for 14 years from the 12th of November, 1841.

This patent was re-issued for amendments of the specification on the 23rd of January, 1845, and noticed at page 250, vol. x, 3rd series of this journal, to which the reader is referred.

37. For an *Improvement in the Churn, for Churning, Working, and Salting Butter;* Lemuel Adams, Redding, Connecticut, April 16.

In the centre of a tube there is a vertical shaft with two horizontal arms, near the end of each of which there is a pendant stud pin, on which rotates a beater, and these beaters have their peripheries grooved, and by the turning of the shaft, the beaters roll around the inner periphery of the tub, and either churn or work the butter.

Claim.—"What I claim as my invention and desire to secure by letters patent, is the use of the horizontal rotary beaters, for churning, working, and salting butter, as herein described."

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38. For an *Improvement in the Brick Press*; A. K. Fahnestock, Harrisburg, Pennsylvania, April 16.

The patentee says: "The nature of my invention consists in attaching to the upper end of the upper lever in the press a slide box and joint, to work on a stem connected with the bottom piece of the mould, in connexion with the present arrangement of the levers and two braces for the slide box to rest on, by means of which, the cap piece of the press is relieved by the forward stroke of the hand lever, after making the pressure."

Claim.—"What I claim as my invention and improvement, and desire to secure by letters patent, is attaching to the upper end of the upper lever, in the above described press, a slide box and joint, to work on a stem connected with the bottom piece of the mould, in connexion with the present arrangement of the levers and two braces, for the slide box to rest on, by means of which, the cap of the press is relieved by the forward stroke of the hand lever after making the pressure."

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39. For an *Improved Instrument for Plotting Surveys;* Wm. J. Card, Lancaster, Pennsylvania, April 16.

Claim.—"What I claim as my invention and desire to secure by letters patent, under the name of the Theolodian protractor, is the application of a graduated circle and nonius or vernier to a movable triangle or right angle, combining, for that purpose, as above described, four pieces of wood or metal, namely, a semi-circle, a sector, a nonius, and diagonal scale of equal parts, which latter also forms a parallel ruler."

Proceedings of a National Convention of Inventors of the United States, held in the City of Philadelphia, October 27th, 1846.

A Convention of Inventors, and others interested in patents, of the United States, convened in the hall of the Franklin Institute, in the city of Philadelphia, October 27, 1846, pursuant to a call of the Executive Committee, appointed by a Convention of Inventors, &c., of the United States, held in the city of New York, October 22, 1845.

Col. Clark, of New York, was called to the chair; and on motion of Charles M. Keller, Esq., of Washington, a committee of three was appointed by the chair to nominate officers for this Convention.

The chair appointed Messrs. Asa Whitney, Capt. Loper, and J. H. Towne, of Philadelphia.

The committee reported the following officers, who were unanimously elected by the Convention:

President,	Isaiah Lukens, Esq., of Philadelphia.
Vice Presidents,	Col. E. Clark, of Brooklyn, N. Y. John Wiegand, Esq., of Philadelphia, E. B. Bigelow, Esq., of Boston.
Secretaries,	George Gifford, Esq., of New York, James Herron, Esq., of Philadelphia.

The proceedings of the Convention held in the city of New York, Oct. 22d, 1845, together with the call of the Executive Committee, being read, the committee, through their chairman, Charles M. Keller, Esq., presented the following report, together with their memorial to Congress, and a copy of the bill reported by the respective committees of both houses of Congress, at the last session.

Report of Executive Committee.

The committee appointed by the Convention of Inventors which met in the city of New York, on the 22nd of October, 1845, have called the present Convention in conformity with the instructions received from the first Convention, for the purpose of reporting the result of their labors. Under their instructions, the committee met in consultation, prepared a memorial as directed, in which they endeavored to present to the Congress of the United States the views of the Convention, to point out the defects in the existing laws of patents, and the beneficial effects anticipated from the proposed change. They then submitted to the committees of the two houses of Congress, and to the Commissioner of Patents, the project of a law amendatory of the existing law. On this project, the Commissioner of Patents prepared a bill, which was approved by the committees in Congress, and by them reported unanimously to the two houses of Congress, and printed; but in consequence of the press of great political questions, and the late period of the session at which the bill was reported, the committees were unable to procure a two-thirds vote, which was necessary to take up the bill out of its regular order on the docket. The committee therefore submit to the present Convention their memorial and the bill reported to Congress.

The committee urged upon Congress all the views of the Convention from which they derived their power; but one of the most important resolves of the Convention, the one which relates to the appointment of special judges, although urged with zeal, was not adopted by the committees of Congress, not because they disapproved the proposition, but for fear that it would lead to much opposition in Congress, and to the defeat of the bill; but recommended to the committee of the Convention the propriety of urging this provision in a separate bill.

All which is respectfully submitted,

CHAS. M. KELLER,
HORATIO ALLEN,
SOLOMON ANDREWS,
JORDAN L. MOTT,
JAMES BOGARDUS,

Executive Committee.

The reading being concluded, on motion of Mr. Gifford, of New York, it was unanimously resolved, that the report of the committee be received.

Clinton Roosevelt, Esq., of New York, presented and read a preample and substitute for the whole bill. His motion was seconded, by a Philadelphian, to allow of the reading.

A long discussion ensued on a motion to refer the Congressional bill and substitute of Mr. Roosevelt to a select committee, in which Messrs. J. Curtis, of New York, C. Roosevelt, William Leighton, of Portsmouth, N. H., H. R. Campbell, of Philadelphia, Jas. G. Wilson, of New York, and Mr. Serrell, of New York, participated; and the question being taken, the motion was not agreed to, and it was finally referred to the Executive Committee.

A resolution was then offered by H. R. Campbell of Philadelphia, to add to the number of the Executive Committee, for a like purpose, which led to a very animated debate by Messrs. Serrell, J. Alricks, of Wilmington, Horatio Allen, of New York, E. B. Foster, of Philadelphia, and C. M. Keller, of Washington; during which there were several amendments proposed, and voted down, as was the resolution itself.

Finally, the Convention determined to take up the bill as reported by the committees of Congress, and pass upon it, section by section.

Action of the Convention on the Bill.

Section 1.—Being under consideration, it was amended by changing the amount of salaries in the bill: for chief examiners from $2500 a year to $3000; and the salaries of assistant examiners from $2000 to $2500.

Sec. 2.—Carried, without amendment, as in the bill.

Sec. 3.—Passed over, by consent, without action.

Sec. 4.—Carried, with the exception of the proviso.

An amendment was offered by Mr. Gifford for the proviso. Pending which, it was resolved, on motion of Mr. Curtis, that when this Convention adjourns, it shall be to meet again at half past four o'clock.

On motion of Mr. H. R. Campbell, the Convention then adjourned.

Afternoon Session.

The Convention met at half past four o'clock, P. M., pursuant to adjournment; and the proviso to section 4, as amended in Congress, being under consideration, Mr. Gifford called up his substitute, which, on motion of Mr. Allen, was referred to the Executive Committee, to be incorporated in the bill, in case provision was not made elsewhere for the object. Agreed to.

Sec. 5.—Mr. Roosevelt moved to strike out the caveat fee of $10, which motion was rejected, and the section adopted as it stood.

Sec. 6.—Was struck out of the bill.

Sec. 7.—Stands in place of 6, and was adopted as in the bill.

Sec. 8.—Mr. H. R. Campbell moved to strike out after line 18, which was not agreed to. Also, after line 28, which motion was not agreed to. The section was then carried unanimously.

Sec. 9.—Was, on motion of Mr. Gifford, amended, and carried unanimously.

Sec. 10.—Concurred in.

Sec. 11.— Do. do.

Sec. 12.—Amended so as to require that the declaration of abandonment be made in the presence of at least three witnesses, and adopted as amended.

Sec. 13.—Agreed to.

Sec. 14.—Carried, with but one dissenting voice.

Sec. 15.—Concurred in, subject to the revision of the Executive Committee.

Sec. 16.—Carried.

Sec. 17.—Amended, by striking out $3 and inserting $2·50 for recording. And striking out 10 cents a volume for examining.

On motion of Mr. Serrell, section 16 was called up for re-consideration, and amended, by a proviso, that the drawings and description shall not be published for six months after the patent has been issued.

Sec. 18.—Agreed to.

Sec. 19.—Struck out of the bill.

Sec. 20.—On motion was amended, by charging cost to the patent fund.

On motion of Mr. Curtis, it was resolved, that the thanks of this Convention be presented to the Executive Committee for the very able and efficient manner they had attended to the duties entrusted to them, and that they be requested to continue the same during the ensuing year.

A vote of thanks was passed to the board of managers of the Franklin Institute, for the use of their hall, in which the Convention sat.

Also, to Col. Clark, for the courteous and dignified manner in which he presided over the Convention.

The Convention then adjourned, to meet again at such time and place, as may be designated in a call of the Executive Committee.

EDWARD CLARK, President.

GEORGE GIFFORD, } Secretaries.
JAMES HERRON, }

SPECIFICATIONS OF ENGLISH PATENTS.

Specification of a Patent granted to JAMES GARFORTH, *of Dukinfield, in the county of Chester, for improvements in machinery or apparatus for connecting metallic plates, for the construction of boilers and other purposes.*—[Sealed 10th December, 1845.]

These improvements in machinery or apparatus for connecting metallic plates for the construction of boilers, consist in the direct application of the expansive force of steam to the dies for riveting such plates together, and in an arrangement of machinery whereby such force is brought into action.

In plate I., fig. 1, represents a plan or horizontal view of an arrangement of machinery or apparatus designed for connecting or riveting metallic plates for the construction of steam-boilers; fig. 2, is a side view; and fig. 3, a section, taken longitudinally through about the centre of the apparatus. *a*, *a*, is the frame-work for supporting the steam-cylinder *b*, *b*, in which a steam-tight metallic or other piston *c*, *c*, works; this piston *c*, *c*, is mounted upon the rod *d*, *d**, which passes out through stuffing-boxes *e*, *e*, at each end of the cylinder *b*, *b*; in the end *d** of the piston-rod the die *f*, is fixed, the other die *g*, being mounted in the pillar *h*, which is fast to the frame-work. Steam being admitted through the entrance or feed-pipe *i*, it passes onwards through a common slide or other valve *k*, to the cylinder; and after having performed its office, is allowed to pass out through the pipe *l*. The side-valve *k*, is worked by hand, by means of the lever *m*, so as to admit the steam on either side of the piston, as required.

The operation of the apparatus is as follows:—Steam of a sufficient pressure being admitted (by means of the slide-valve *k*,) at the back, or as it appears in fig. 3, of the drawing, at the left-hand side of the piston *c*, *c*, that piston will be forced, together with the piston-rod *d*, *d**, in the direction of the arrow, and form the ends of the rivet *n*, between the two dies *f*, and *g*; thus firmly connecting the plates *o*, and *p*, and thereby producing a perfectly steam, air, or water-tight joint.

The head of the rivet is formed at one or more blows, as required; the intensity of the blow depending upon the area of the piston, the length of the stroke, and the pressure of the steam employed. The valve *k*, is then reversed, to admit the steam in front of the cylinder; which movement will withdraw the die *f*, when another rivet may be put in, and the operation proceeds as before.

The patentee remarks, that he does not intend to confine himself to the use of steam alone for such purposes, as the direct pressure of water, air, or other elastic medium may be similarly employed, without departing from the principle of his invention. He states, that he does not claim the exclusive use of the several parts of the above-mentioned apparatus, when taken separately, but only when employed for the purpose of his invention, which consists in the riveting of metallic

plates by dies, driven by the elastic force of steam, water, or other elastic medium, as above described.—[*Inrolled June*, 1846.]

Lon. Jour. Arts & Sci.

Specification of a Patent granted to WILLIAM HENRY WALLER, *of Lambeth, in the county of Surrey, for improvements in sluice-cocks.*—[Sealed 31st October, 1845.]

The patentee commences his specification by pointing out the defects of the sluice-cocks now generally employed, which are liable to leak, and quickly become injured by use. His invention consists in applying movable bushes or facings to sluice-cocks, and in constructing the bushes in such a manner that they shall be harder, and fit more truly, and may be more readily applied, and replaced when worn; it further consists in a mode of rendering the working surfaces of sluice-cocks, which are made without movable bushes, more hard and durable.

In Plate I., fig. 4, is a vertical section of the improved sluice-cock; fig. 5, also represents a vertical section, taken on the line A, B, of fig. 4; and fig. 5*, is a horizontal section, taken on the line C, D, of figs. 4 and 5. *a*, is the body of the cock; and *b*, *b*, are portions of two pipes, which enter the sockets of the cock, and are retained therein water-tight by the application of melted lead, in the usual manner. The body of the cock is bored out at the points 1, 2, 3, and the backs of the bushes *c*, *c*, are turned in a lathe, so as to fit the recesses thus formed. The bushes are made, by preference, of cast-iron (although other metal may be used;) the working surfaces 4, 4, are chilled in the act of casting, and are ground or "faced up" with emery in a lathe. The bushes are coated on their backs with marine glue, or similar material, previous to introducing them into the cock; and after the bushes have been introduced into the cock, they are moved back in the recesses before mentioned, into a proper working position, by forcing down the plug *d*, into its place. The patentee does not confine himself to the shape of the recesses formed in the body of the cock, as that may be varied. *e*, is a screw for raising and lowering the plug; *f*, is a screw-nut, fitted into a recess at the top of the plug; *g*, *g*, are ribs, formed on the interior of the upper part of the cock; and *h*, *h*, are corresponding ribs on the outer surface of the upper part of the plug; the use of the ribs being to guide the plug correctly in its movement up and down. The surfaces 5, 5, of the plug are chilled in the act of casting, and are then ground with emery.

When making sluice cocks without movable bushes, the patentee causes the surface against which the plug works to be chilled in the act of casting the body of the cock, so as to make it more durable; and this surface is afterwards rendered true by means of a revolving tool and emery.

The patentee claims, Firstly, the mode of preparing the bodies of sluice-cocks with recesses for receiving bushes; the planes of the surfaces 1, 2, 3, being inclined to the central line of the barrel

of the cock, as above described. Secondly,—the mode of applying movable bushes to cocks. Thirdly,—making the movable bushes, and also the plugs of sluice-cocks, with chilled working surfaces, as described. Fourthly,—the making of sluice-cocks with chilled surfaces, which form the bed of the plug.—[*Inrolled April*, 1846.]

Ibid.

Specification of a Patent granted to JOSEPH COWEN, *of Blaydon Burn, near Newcastle-upon-Tyne, for his invention of certain improvements in making retorts for generating gas for illumination.*—[Sealed 4th June, 1844.]

These improvements in making retorts for generating gas may be considered under two heads; firstly, the new combination of earthy and other materials, of which the retorts are to be constructed; and, secondly, the novel kind of moulds and machinery by which the retorts are to be shaped and manufactured.

The object of the patentee is to make such clay retorts for generating gas, as will be capable of withstanding the effects of the various changes of temperature to which they are required to be exposed, and consequently render them less liable to crack. To accomplish this, he proposes to mix with Newcastle fire-clay, Stourbridge fire clay, or any other kind of clay suitable for the purpose, saw-dust, pulverized wood, charcoal, coke, carbon obtained from the interior of gas retorts, and other carbonaceous materials, in such proportions as the quality of the clay may require. The more aluminous the quality of the clay, the larger will be the quantity of carbonaceous matter required to be combined therewith. From one-twentieth to about one-fourth, by measure, of carbonaceous matter, compared to the whole mass of earthy materials employed, may be combined; this variation of quantity depending, as before stated, upon the aluminous condition of the clay,—a feature well understood by potters and the makers of clay retorts. By these means the clay is rendered partially porous, and consequently less liable to crack by the changes of temperature. Clay retorts for the generation of illuminating gas, of all forms and structures, may be made of these combinations of earthy and carbonaceous materials.

The second part of this invention applies to the peculiar kinds of moulds, and the machinery to be employed, for manufacturing gas retorts from earthy materials, which will be seen by reference to Plate I.

Fig. 6, represents the external appearance, as seen from above, of the improved machine for forming retorts of clay by compression; fig. 7, is an end view of the same; and fig. 8, shows the internal parts of the machine, by means of a longitudinal section, taken vertically. *a*, *a*, is a cylindrical box or chamber, into which the plastic clay and other materials are to be introduced, through a man-hole or aperture *b*, at the top; *c*, *d*, is a core, made towards the end *c*, to the figure of the required internal form of the retort, the other part of the core *d*,

being cylindrical and hollow, for the sake of lightness. This core is placed concentrically within the cylindrical box or chamber *a*, and is made fast thereon by a stud and key *e*, to the end plate *f*, *f*, of the cylinder. A circular plate *g*, acts as a piston within the cylinder, sliding over the core *d*, for the purpose of compressing the plastic clay and other earthy materials contained therein; which piston has several rods *h*, *h*, *h*, affixed to it, whereby any actuating power or mechanical force may be applied to drive the piston forward. To the front end of the cylinder there is attached a nose-piece *i*, *i*, with a plate *k*, which, together, may be called the mould; for, on the piston being forced up, the plastic clay is made to fill up the nose-piece, and to mould or form the end of the intended retort; which, when the machine is in operation, will be known by small portions of the clay oozing through the hole or holes in the front plate *k*. It will be seen by the drawing, that the retort about to be made by this machine is nearly of the transverse sectional figure of the letter D; but to this figure the inventor does not confine himself, as any other form of retort may be made, by means of the same machinery, by altering the shape of the nose-piece *i*, *i*, and the end part of the core *c*, both of which are made movable for that purpose.

The end of the intended clay retort being thus formed in the nose part of the machine, the plate *k*, must be removed from the nose; when, on forcing the piston, *g*, forward, the plastic clay will be projected out at the end of the nose in the shape and as a continuation of the retort (the end of which had been formed as described), to any length required, in the manner shown by the sectional fig. 8, where it may be received and supported by an endless traveling cloth, or a board and rollers; and the length of moulded clay may then be cut off by a wire in the ordinary way, and sent to the drying place.

Another form or modification of this machine is shown in longitudinal section at fig. 9, in which, instead of the nose-piece above described, a D-formed hoop *l*, *l*, or of any other required figure, is introduced as a die; which, in commencing the operation of making the end of the clay retort, must be kept in its place, and the front of the cylindrical box closed by a plate *k*, as before. The core *c*, formed to the desired internal figure of the retort, is in this instance made fast to the piston *g*, and advances with it. When the end of the retort has been made as before described, the plate *k*, must be removed, and on now projecting the clay forward, it will assume the moulded form shown in the front view, fig. 10, and in the section, fig. 11, in which the plate *k*, is removed. Under some circumstances the patentee proposes to use (instead of the machinery above described) peculiarly constructed hand moulds, shown at figs. 12, and 13, for the formation of clay retorts. These moulds may be made either of wood, metal, or plaster, in two or more parts, according to the size and figure required. Fig. 12, shows a top view of one of the moulds of a D form, which is the shape most commonly used. The mould is curved at *a*, *a*, the part which is to constitute the roof or top; the bottom *b*, is a flat plate, capable of being detached, which is best suited to this form, and to ordinary-sized retorts. The two, or it may be more, parts of the

mould, when combined, are to be made fast by external bracings of iron hoop *c*, *c*, with a bar *d*, keyed or screwed thereto; or, if the mould is made of plaster, rope bracings will suffice.

In commencing the operation of moulding a clay retort by means of this apparatus, the interior of a single mould is uniformly worked over, by hand, with a substantial coating of the clay; the clay is then beaten down to any required uniform thickness, which may be from about two to four inches. When this first mould has been thus coated, and so much of the clay retort shaped and finished, a similar mould is to be placed upon the top of the former, their edges perfectly coinciding, and they are then to be bolted together. This being done, the interior of the second mould is coated with clay, in like manner to the first; taking care that the plastic clay of the second operation shall be perfectly united with the edges of that produced in the former mould. In this manner the retort may be continued to any length, by erecting one mould upon another, and carefully joining them, as shown at fig. 13. In some cases it will be found desirable to line the internal parts of the moulds with flannel or cloth, to prevent adhesion. It may be necessary for the moulds to remain upon the moulded retort for some hours, in order that the clay may become perfectly stiff before they are removed; but of this no precise instructions can be given, as it will vary, and must depend upon the consistency or stiffness of the materials used.

The patentee claims, Firstly,—the introduction, or mixing, of carbonaceous matters with the clay, previously to its being moulded into retorts for generating illuminating gas; Secondly,—the novel kinds of moulds and machinery for forming retorts of clay and other earthy materials, intended for the generating of gas, as above described.—[*Inrolled December*, 1844.] Ibid.

Specification of a Patent granted to Thomas Lever Rushton, *of the county of Lancaster, for certain improvements in the manufacture of iron.*—[Sealed 21st June, 1844.]

This invention relates to the manufacture of malleable iron in reverberatory furnaces.

The first improvement consists in mixing hammer slack, roll scale, red ore, calcined iron stone, or other oxide, in a pulverized state, with a proportion of finely pulverized charcoal, coke, or other suitable carbonaceous matter (which should be as free as possible from sulphur,) and introducing the mixture into the furnace before, or along with, or immediately after, the charge of pig or refined iron. The mixture of ore and carbonaceous matter is turned over from time to time, until the iron is melted, and then they are worked together in the usual way. The patentee says, that this process is very similar to that described in the specification of a patent, which was granted to W. N. Clay, March 31, 1840; but, in the present instance, the proportion of carbonaceous matters varies from 17 up to (but not including) 28 per cent. by weight of the ore or oxide; whilst Clay's invention

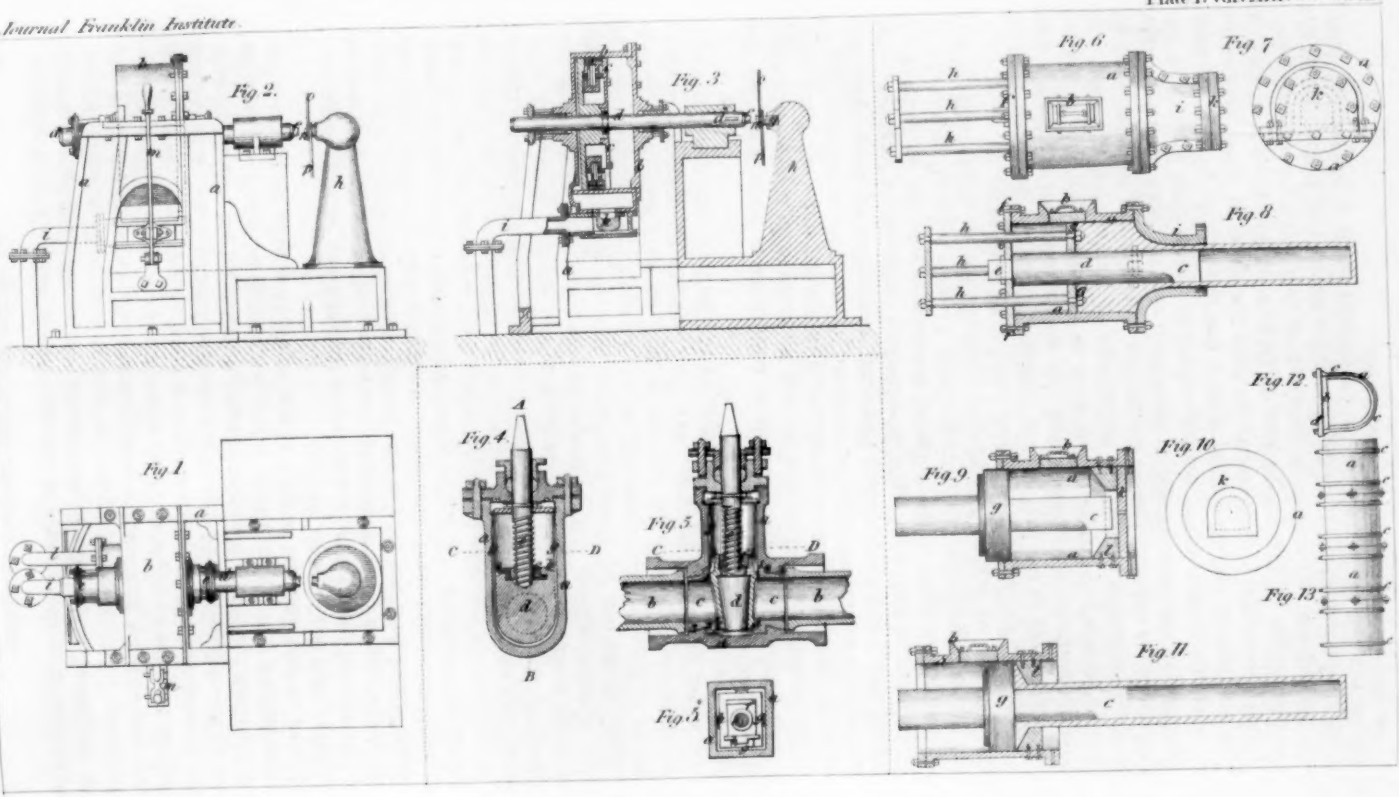
Fig 1
Fig 2.
Fig 3
Fig 4
Fig 5
Fig 6
Fig 7
Fig 8
Fig 9
Fig 10
Fig 11
Fig 12
Fig 13

was confined to the use of not less than 28 per cent. The proportionate weights of carbonaceous matter and ore or oxide employed, within the above limits, depend upon the quantity of carbon and oxygen they respectively contain, the description of pig-iron used with them, and the amount of pig-iron to be added to the mixture. The following proportions produce an abundant yield of excellent iron:—480 lbs. of No. 4 pig-iron, 84 lbs. of Lancashire hematite ore, and 20 lbs. of coke-dust: if No. 1 pig-iron be used, a smaller quantity of carbonaceous matter will be required; but if the charge of No. 4 pig-iron be reduced to 420 lbs., the weight of ore or oxide should be increased to 180 lbs., and the coke to 48 lbs.

The second improvement consists in the addition of clay, argillaceous ironstone, or other substance containing alumina, to the ores or oxides which produce iron of the quality termed red-short. The clay, or other substance used, should be ground fine and dried, before being mixed with the ore. A larger quantity of carbonaceous matter (generally above 28 per cent.) will be required for a given quantity of ore, than if no clay were used; for the clay, in addition to its capability of taking up the carbon, has a tendency to diminish the contact of the ore or oxide with the carbonaceous matter, and thereby prevent a complete decomposition. The proportion of clay will vary with the quality of the ore, but from 4 to 10 per cent. of the weight of the ore will be sufficient when operating on the Lancashire hematite ores. If too much clay be used, the tap cinder will be very sluggish, and the ball, when under the hammer, will emit continuous showers of dark red cinders: and if too little be employed, the iron will retain some of its red-short quality.

The third improvement consists in combining a portion of the tap or flue cinder of puddling and balling furnaces with a portion of clay, chalk, carbonaceous matter, and rich iron ore, or some of these substances, and manufacturing the mixture (either with or without pig or refined iron,) in reverberatory furnaces, into malleable iron. The materials must be pulverized and dried before being mixed together. The relative proportions of the different substances may be as follows:—150 lbs. of tap cinder, containing about 71 per cent. of protoxide of iron, 150 lbs. of Lancashire hematite ore, 20 lbs. of pulverized Worsley fire-clay, 20 lbs. of chalk, and 100 lbs. of coke-dust.

With regard to the first part of this invention, the patentee says he does not claim to have discovered the manufacture of malleable iron in reverberatory furnaces, either with or without a portion of pig, or scrap, or refined iron, nor the advantage of pulverizing the ores and carbonaceous matter; but he claims the manufacture, in reverberatory furnaces, in the manner above described, of malleable iron, by means of ores and carbonaceous matter, mixed in proportions limited as before mentioned, and combined with a portion of pig or refined iron. Under the second improvement, he does not claim to have discovered the advantage of using a portion of clay or argillaceous ironstone in the manufacture of iron from certain ores, that having been previously done in the manufacture of pig-iron from such ores; but he claims the use of clay as an ingredient to be employed in a pulverized state,

mixed with certain ores and carbonaceous matter, also pulverized for the manufacture, both with and without pig or refined iron, of malleable iron in reverberatory furnaces. With regard to the third improvement, he does not claim to have first applied a portion of tap or flue cinder or other silicate of oxide of iron with lime or carbonate of lime, and with iron ore, clay, and carbonaceous matter, all these having long been used in the manufacture of pig-iron; but he claims the manufacture of malleable iron from the combination of those substances, pulverized (both with and without pig or refined iron,) in reverberatory furnaces, as before described.—[*Inrolled December*, 1844.] Ibid.

MECHANICS, PHYSICS, AND CHEMISTRY.

New Saccharimetric Process. By M. Eug. Peligot.

The author communicated to the Society of Encouragement, in its sitting of the 15th April last, a process of assaying crystalized sugar, as well as sirups, by means of lime.

This process, which is applicable to sugar, in a solid or crystalized state, such as raw sugar, as well as to liquid sugar, whatever be its nature and origin, requires no other instruments or re-agents than those which are found in all manufactories and no more skill than is necessary to make an alkalimetric assay. It is based upon the action, essentially different, which alkalies exercise over the two sorts of sugar, the ordinary cane or beet root sugar, and the glucosus, or sugar from starch, raisins, and fruits.

The ordinary sugar combines with alkalies, and forms, with the bases, or chief ingredients, compounds in defined proportions, from which the sugar may be extracted without having suffered the least alteration.

The glucosus also combines with alkalies; but it produces compounds of so volatile a nature, that it is impossible to preserve them for more than a few moments. In fact, if a solution of glucose and potass be left to itself, at the ordinary temperature, the quantity of free potass contained in the liquor is observed to diminish every day, and eventually disappears entirely where the glucose is employed to excess. The glucose transforms itself, in effect, into one or more acids, which give to the liquor a brown color, and form, with the potass, neutral salts.

The action slowly exercised by the alkalies over the glucose, at the ordinary temperature, develops itself instantaneously on the solution of these bodies being boiled; in a few minutes, the transformation of the glucose into these acids takes place in a complete manner.

The alkali used by M. Péligot, for his saccharimetrical assays, is lime. It is known that pure water dissolves only a thousandth part of its weight of lime, whilst saccharine water dissolves a considerable quantity, in proportion to the weight of sugar which it contains.

To make an assay of raw sugar, 10 grammes of this sugar are weighed and dissolved in 75 cubic centimetres of water; to this solu-

tion is added, by degrees, 10 grammes of slack lime, sifted and prepared in a glass or porcelain mortar, and beaten for about eight or ten minutes; then the mixture is passed through a filter to separate the undissolved lime, the chief ingredient having been employed to excess.

It is advisable to pass the liquor a second time through the filter, in order to be able to dissolve the whole of the lime which combines with the sugar. Then take, with a graduated measure, 10 cubic centimetres of the solution of saccharate of lime, diluted with from 8 to 10 decilitres of water; then pour into this liquor a few drops of blue litmus, and saturate it with a solution of sulphuric acid. A quart of this proof liquor contains 21 grammes of sulphuric acid to 1 equivalent of water. A quart of this liquor will saturate the quantity of lime dissolved by 50 grammes of sugar.

The first solution of sulphuric acid is introduced into the alkalimetric assay vessel, or into a vessel graduated to cubic centimetres, each of which is divided into 10 parts. This vessel being filled up to zero, the acid liquor is poured into the alkaline solution, which is kept in agitation until the blue tint of the latter turns to red, under the influence of the last drops of the proof liquor.

By observing, on the divisions of the vessel, the quantity of pure acid which it was necessary to employ to attain this point of saturation, the quantity of lime and likewise of sugar contained in the solution of saccharate of lime is given:—the total contents of this solution is also known, by means of M. Payen's table for estimating the volume produced by specific weights of sugar and water.

For the ordinary raw sugars, destined for refining, the assay stops here; but it often happens that it is adulterated with *glucose*. In order to detect this fraud, and likewise to analyze the molasses and the sugars of inferior quality, proceed at first in the manner indicated for raw sugars.

After the first alkalimetric assay, introduce into a medicine phial a portion of the alkaline liquid, heated to 100 degrees, in a vessel of hot water, for several minutes. If this liquor contains only the saccharate of lime, produced by the ordinary sugar, it becomes troubled by the action of the heat, owing to the property possessed by this calcareous compound, of coagulating when heated to 100 degrees; but this agitation ceases by the cooling of the liquor, which does not assume a deeper tint than before it was heated. In submitting it to a second alkalimetric process, after it has cooled, it returns to its primitive state.

But if the saccharine produce contains glucose, the solution heated by the hot water assumes a brown tint, and it leaves a brown deposit, which does not disappear after its cooling. If the glucose is in large quantity, it throws out a decided smell of burnt sugar. Lastly, the second alkalimetric assay gives a less quantity of lime than the first; this quantity appertains entirely to the ordinary sugar, the lime dissolved cold having produced neutral salts, on which the pure liquor of sulphuric acid has no action.

When heating pure glucose, the first alkalimetric assay, after the lime has been ground with the liquid in a cold state, would produce

nearly the same alkaline proportions as ordinary sugar; the second assay, made with a portion of the liquor, heated to 100 degrees, would produce the same quantity of lime as that which was dissolved by an equal volume of pure water. This quantity is very small, and will saturate 4 cubic centimetres of the pure solution of sulphuric acid per decilitre.

Although the liquor assumes a brown tint, the point of saturation may be easily determined by adding thereto a little more litmus, and stopping immediately, the solution, which has become of a greenish tint, assumes a clearer hue by the addition of sulphuric acid.

The assaying of saccharine liquids is carried on in the above manner; it is only necessary to have the precaution to operate on liquors marking 6 or 8 degrees on the areometer of Beaumé.

The juice of beet root and sugar possesses these properties. The quantity of slack lime employed in these liquids should be almost equivalent to the presumed quantity of sugar in the produce to be assayed: this quantity is shown approximatively by the areometric degree of the liquor.

Lond. Jour. of Arts and Sci.

On the Manufacture of Gas for Illumination from Water. By M. Jobard.

[From the Bulletin du Musée d'Industrie.]

A certain quantity of carburetted hydrogen gas, suitable for illuminating purposes, may be produced by the distillation of coal, rosin, fatty matters, and oils; but at the same time, a considerable quantity of hydrocarburets of hydrogen is produced in the form of tar, napthaline, paraphine, pyrogenous oils, &c., which are deposited in the apparatus, either in a liquid or solid form.

Now these substances, which are rendered useless and injurious to the manufacture of the gas, by the present mode of operating, are precisely those which are the most rich in illuminating properties. It has, therefore, been proposed to dissolve these hydrocarburets in hydrogen gas possessing no illuminating properties, and thereby rendering it capable of affording light, as the carbon is the source of the illuminating power. The whole of the year 1833 was devoted to experiments for this purpose, and to the production of apparatus for charging with carbon the hydrogen gas produced by Dobereiner's lamp.

These experiments were successful beyond expectation, and the result was laid before the Royal Academy of Brussels, upon which they appointed a commission to inquire into it, by whom the following report was presented in the sitting of 4th January, 1834:—

"The commission appointed at the last meeting, to examine the effect of the lamp constructed by M. Jobard, now presents its report, from which it appears that the commissioners are convinced that the gas burnt with a very white and brilliant flame (equal to 36 candles of six to the pound,) and that, being desirous of ascertaining its illu-

minating power, by a comparison of the shadows, they find that the light of this gas, issuing from a 12-hole Argand burner, is at least double that of the coal-gas furnished by the Brussels Gas Company when burnt in a 12-hole Argand burner, pierced with holes three times the size, which are employed for lighting most of the shops in this town. These observations appear completely to answer the questions put by M. Jobard to the Royal Academy.

"In order fully to appreciate his invention, it should be worked on a large scale, and an account kept of the economy effected, which he could not communicate to us without making us acquainted with his mode of operating, and which he wishes to keep secret."

The commission being desirous of seeing this invention worked on a larger scale, I had a gasometer constructed, and burners placed in every apartment in my house; a single burner was sufficient to light the largest room brilliantly, and a saving of several centimes was effected for each burner: this resulted from sulphate of iron being produced during the operation. The gas was charged with carbonaceous vapors by passing it through a cylinder containing about two quarts of oil of gas-tar, which was not exhausted at the expiration of eight days, during which time the experiments were continued. I think it right to enter into all these details for the benefit of those persons who might feel desirous of taking up this invention, which is on the eve of becoming public property.

Some doubt still remained as to whether the gas would retain the illuminating power after being confined in gasometers and traversing a considerable length of pipe; it appeared to me that very likely, in winter-time, the carbon mechanically combined with the gas, might become disengaged and deposited.*

The following fact, contained in Thenard's Treatise on Chemistry, was sufficient to put me in the right path:—*Gases combine at the moment of formation.*

A brevet was taken by me in Belgium for the production of hydrogen gas, by the decomposition of steam in vertical retorts, filled with incandescent coke, and for uniting this gas, *at the moment of formation*, with hyper-carburetted gas produced by the distillation of fixed oils, or any other hydro-carburets. I afterwards went to Paris, where, by deed, I gave up my invention to Messrs. Selligue and Tripier, in consideration of the sum of 10,000 francs and a third of the profits, on condition that M. Selligue should pass as the inventor; and as such he received the large gold medals from the Society of Encouragement and the Academy of Industry. He was about to receive the gold medal at the exhibition of 1839, and also the Cross of the Legion of Honor, for what Baron Thenard called *this splendid invention*, when I was summoned before a jury to declare the truth.

It was useless to dissemble before a jury composed of such men as Baron Thenard, Gay Lussac, Brongniart, Darcet, Dumas, Payen, &c. I simply shewed my Belgic brevet, our agreement, and M. Selligue's

* This was the case in winter-time at St. Vallier, near St. Etienne, in the manufactory of Messrs. Chareten & Son, lighted by 240 burners.

receipt. The case was not long in being decided; the Selligue gas, and also the Selligue system of sinking wells, which I had given up to him by the same agreement, were both deprived of their false name at once.

Mr. Selligue has, however, contributed his mite, for he constructed several horizontal furnaces, which would not work, before he adopted my vertical plan, and which worked successfully at Antwerp, the description of which will be given hereafter.

The towns of Dijon and Strasburg, and two of the fauxbourgs of Lyons and Paris had been for some time lighted with this gas, which, after being opposed for some time by powerful continental gas companies, was on the point of sinking into oblivion, when it was taken up in Dublin and even in London.* It was with great pleasure I saw it come into use in that country, abounding with coal, as I thought it would only be used in those countries where coal is scarce and dear; a plan was then adopted in Paris, which I had previously proposed, and which consisted in causing gas obtained by the decomposition of water, to take up hydro-carburets produced by the distillation of coal gas, at the moment of its formation. Twice or thrice the quantity of illuminating gas could be obtained by this means than by the ordinary method. The illuminating power of ordinary gas might also be easily doubled by passing it through a vessel filled with carburets of hydrogen, slightly heated, as described in my brevet.

By combining pure hydrogen gas, at the moment of formation, with coal-gas, charged with an excess of carbon, the necessity of purifying it is done away with, as the ammonia and sulphurets of hydrogen liberated are dissipated and lose their intensity; but by employing oil of schistus, or fish, or other oil, any purification will be unnecessary; this is, therefore, another advantage.

Being desirous of making the public acquainted with the advantages of this new system, and not having any further interest in the matter, I think it right to state the reasons which were given in opposition to it, by publishing the report read by M. Arago, at a meeting of the Academy of Sciences, December 3rd, 1838.

I will also refer to the Bulletin of the Society of Encouragement of the same year, for the report of Messrs. Dumas and Payen, in consequence of which, one of the grand prizes of the Society was granted to M. Selligue.

In the following year a patent was taken in England, in the name of M. de Val Marino. About the same time, this invention found its way into Austria, and fell into the hands of M. Offenheim, by whom it was offered for sale in Belgium to the inventor himself, with whom M. Offenheim was not acquainted.

To return to the explanations presented to the Academy of Sciences —they are as follows:—

Hydrogen gas is charged with carbon by passing it through a hollow cylinder, *heated to redness*, where it meets with highly carburetted

* Gas made from water was used in Dublin by Mr. Kelly, of Upper Gloucester-street; in London, by Mr. Stones, of 25, Golden-square; and under the arches of Waterloo Bridge.

oils. A chemical combination, and not merely a mixture, then takes place, as is proved by the analysis of M. Peligot, Professor at the Polytechnic School, which was as follows:—

Carburets of hydrogen, - -	57
Oxide of carbon, - -	28
Free hydrogen, - -	15
	100

The theoretical question of illumination is therefore as follows:—

"*What is the process which will produce the largest quantity of light from* 1 *lb. of either oil, resinous matter, schistus, or coal-tar?*

"One pound of oil of rosin or schistus produces in the new apparatus 35 cubic feet of gas, 3 feet of which are burnt in an hour in a burner giving a light equal to ten candles, which is equal to 23 hours light. Now, at Belleville, Antwerp, Frankfort, and wherever gas has been manufactured from *oil of rosin*, and from pure rosin, the average quantity produced was from 7 to 9 feet for every pound of oil, but in three or four days it fell to from 6 to 8 feet. Separate experiments with new retorts may furnish from 12 to 13 feet, and the production of this quantity has been announced by M. Tailleberg as a grand discovery. Let us take this quantity, although it is nearly double the average; two feet and a half of this gas must be burnt per hour to furnish a light equal to ten candles, according to a report upon the lighting of the town of Antwerp, in October, 1837, with rosin gas, and in October, 1838, with gas made from water. Let us only reckon 2½ feet;—1 lb. of oil therefore furnishes 6½ hours light, and admitting 17 feet for every pound to be the product, which cannot be obtained without the addition of water, it would even then only give 15 hours light, whilst the water-gas furnishes 23."

But there are other facts which can be proved without dispute. The production of gas from water does not stop at 35 feet per pound. By augmenting the quantity of water with respect to the oil in the apparatus, the gas becomes weaker and weaker, until its density approaches and even exceeds that of coal-gas. In experiments made with more than 1500 cubic feet, and watched for several consecutive hours, the rate of production was 111 feet of gas for every pound of fish oil (oil of schistus produced exactly the same result.)

It was only necessary to burn 6 feet of this gas in order to produce a light equal to 10 candles, which was but in a very slight degree less brilliant than coal-gas. Gas produced at the rate of 55 feet per pound of oil of schistus gave a consumption of 4 feet in the same burner. Thus, supposing the water-gas to be produced at the rate of 80 feet to the pound, it is equal in power to the coal-gas, and burns but 5 feet per hour. One pound of oil will therefore give 20 hours light. Let us reckon the cost of this illumination with oil of schistus, which only costs about 2*s.* for every 100 lbs., and a consumption of combustibles which is diminished in proportion to the quantity of gas produced and the size of the apparatus; whilst, on the contrary, with rosin gas, as the decomposition of the gas takes place on the surface of the me-

tal, the small retorts are the most advantageous; and, at the same time, the mass of gas produced is not augmented, but simply its volume, and this only by decarburating the richest portion of the carburets of hydrogen, by the action of a higher temperature.

The indefinite augmentation of the light obtained from the water-gas, in proportion as it is produced weaker or stronger, tends to prove that the presence of oxide of carbon augments the illuminating power of gas, no doubt augmenting at the same time the quantity of heat developed during combustion.

I shall not, therefore, be accused of exaggeration when I state that there is some value in a process, the principle of which is to decompose water, a substance of no value, by means of coke, which is of very little value,—as under this process, 1 lb. of oil, which costs a halfpenny, will supply a burner giving a light equal to ten candles, during twenty hours. Ibid.

The Staffordshire Potteries.

Pottery is one of the most ancient and characteristic branches of national industry; we know of no product of mechanical ingenuity so early discovered as the potter's wheel, and in the Eastern hemisphere its use appears to have been almost universal from a date lost in the darkness of remote antiquity. Some forms of the fictile art were known to the natives of America before that continent was discovered by Columbus; but, though the wheel seems to have been unknown, a simple contrivance was employed which was no bad substitute; it was simply a stick which the workman held by the middle and twirled round inside whatever vessel he fabricated, to ensure its circular form. The Egyptians were probably the first who attempted to apply the Decorative Arts to their productions in earthenware; but the Greeks soon surpassed them in this respect, for they sought ideal beauty in form and color as well as in ornament. Their colonies in Italy still further extended the manufacture and the range of decoration: while the Etrurians established a school of Art of their own, which attained in its peculiar branches the highest degree of perfection.

Without entering on the history of pottery in modern times—a subject too important to be discussed incidentally—we may notice that most of the European nations have been anxious to cultivate this branch of manufacture, and that even monarchs have not thought the production of porcelain unworthy their attention. In England, where everything is left to the exertions of the people, and nothing is derived from the protection or patronage of the Government, the development of the production of porcelain and the finer kinds of earthenware has been equally spontaneous and extraordinary. Wedgwood was to this branch of industry what Arkwright was to the cotton trade; he lived to see the fictile art brought to high perfection, and to see that his success had stimulated worthy rivals to emulate him in extent of production and beauty of the article produced. Unfortunate-

ly the similarity extends further: the mills held by the descendants of Arkwright are about the worst in the kingdom, and the successors of Wedgwood in the works of Etruria do not continue, much less extend, the production of those works of high Art which first gave celebrity to their house. It may be said, and it has been said, that the manufacture of coarser and cheaper articles is more lucrative than the production of vases and figures; that the sale of articles of luxury depends mainly on the caprice of fashion; and that the demand for copies of the antique must necessarily be very limited, as it requires a cultivated classical taste to appreciate their merits. But the advantages of the reputation acquired by a house for superior artistic productions must not be measured by the immediate pecuniary returns. The character extends to all their productions: the merit of the figure castings at Coalbrookdale is received by the world as a pledge for the excellence of their gates, umbrella-stands, and other articles of domestic utility. And it is justly so received; every operative in an establishment feels strongly the duty of maintaining the reputation of the house: taste is diffusive in its nature; "a little leaven leaveneth the whole lump."

The national importance of the Potteries in a commercial point of view is not yet thoroughly appreciated; they call into exercise large powers of chemical analysis and mechanical ingenuity; they develop largely the artistic faculties; they bring into action masses of intellect which would otherwise have lain dormant and useless to the country. Our export trade in earthenware is steadily on the increase, and is capable of almost unlimited extension. * At home, comfort and convenience have been wondrously increased since ware has superseded pewter; and the sanitary condition of the community has been benefited by the improvement. Never yet did manufacturers seek for beauty without finding that they advanced in economy and utility as well as in excellence.

The days have gone by when the higher branches of Industrial Art depended for their progress upon the patronage of princes or of nobles. Henceforth improvers must look for their reward to the people, and through the people to the world's markets. It is for this reason that we have undertaken this series of articles;—articles which have imposed upon us more toil, more care, and more expense than we could possibly have anticipated when the series was commenced. But it is of importance that the English people should have some knowledge of the nature and extent of their own commercial resources, for without such knowledge they can never properly appreciate their national interests. Had such knowledge been previously disseminated, we should have escaped many embarrassing discussions, which have distracted the attention of the country and interfered with the steady progress of society. The state of THE POTTERIES requires some prelimi-

* From the weight and bulk of the pottery goods, they are eagerly sought as freight, and shippers regularly canvass for their transit. The prices at which they are conveyed to all parts of the world are, consequently, astonishingly low; in some cases they appear almost incredible: for instance, a crate of goods which would cost 4s. carriage from the Potteries to Liverpool can be conveyed from that port to America for 6s.

nary explanations belonging rather to the mechanical forms of production than to questions of Art; but the two subjects are so very closely blended that we deem the one necessary to the correct appreciation of the other.

The discovery that the ductile argillaceous earths could, by the action of fire, be made to retain the endless diversity of forms they so readily assume under the hand of the potter, seems to have been made by almost all nations at a very early period in the history of their civilization. The relics continually brought to light among the ruins of past glory, in every quarter of the globe, give convincing proofs of the universality and antiquity of this art. The cause of the earthenware manufacture fixing itself in this locality is obvious—colored marls and clays of which the early pottery was made, and an abundant supply of coals to *fire* them, being procurable on the spot, in any quantity.* The early potters required nothing more. That its origin dates from a very remote period—some contend as far back as the Roman possession of Britain—there can be no doubt. † We have conclusive proofs, however, that, two centuries ago, earthenware was made here to a considerable extent; and from such evidence we may infer that the earlier productions of the district were notorious and extensively used. About the time we speak of, the moorlanders of the surrounding country had established a trade in butter, which they sent to London and other large towns, and their neighbors the potters supplied them with tall and narrow cylindrical earthen vessels called "butter-pots;" as the readiest and cheapest packages for the article. In 1661, an act of Parliament was made to regulate the size and weight of these butter-pots, to counteract the nefarious practices of certain "little country moorlandish cheats (than whom no people are deemed more subtle,") as Doctor Plott says. These pots were made of the common brick clay of the neighborhood, the workmanship being of the rudest character, and each jar bore an official stamp.‡

* At the present day the finer materials required for pottery purposes are brought from considerable distances. The flint is from Gravesend and Northfleet, 650 miles; various clays and stones from Cornwall, Devon, and Dorset, varying from 300 to 460 miles. These distances are reckoned by water carriage to Liverpool, from which place the materials are conveyed to the Potteries by canal, thus adding another 50 miles! The chert-stone, for the grinding-mills, is from Wales. Gypsum, which yields the plaster of Paris of which the moulds are made, is from Derbyshire. The cost of transit is heavy: for instance, the clay which in Cornwall sells at 18s. per ton, costs in the Potteries from 36s. to 38s. China clay—in Cornwall, 27s. per ton; Potteries 43s. 6d. Devon and Dorset blue clay—in Cornwall, 18s. per ton; Potteries 36s. Black ditto, Cornwall, 12s.; Potteries 27s. per ton.

† The Roman glazing appears to have been a compound of varnishes; and Pliny is of opinion that it was made of bitumen. He affirms that it never lost its surface and beauty, and that it had become customary to glaze even statues in this manner. As the varnish sank deep into the substance of the ware, it was not subject to cracks or flaws, and, as it was not liable to corrosion by the use of acids, was free from the objections urged against the use of vessels glazed with lead.

‡ The quantity of goods made at that time was so small that Dr. Plott says, "The chief disposal of them was to poor cratemen, who carried them on their backs all over the country." Such was the rudeness of the district at this time that, according to Shaw, "all the clays and most of the coals for the twenty-two ovens weekly filled in with the different kinds of ware (crouch, black, mottled, cloudy, &c.) were obtained *from holes in the streets and sides of the lanes!*" many of which were still open in 1829, when his history was published.

No part of the history of pottery is more obscure than that of the origin and progress of "glaze," by which is meant the semivitrified surface spread over earthenwares, which at once gives it a lustrous exterior, and renders it impermeable to water. On some of the ancient vessels of the south of Europe and of Asia there are found some traces of a glaze so exceedingly thin that it is almost impossible to determine its composition even by approximation. The French chemists believe it to be a silicate either of iron or of lime rendered soluble by a silicate of soda in an inappreciable proportion. Half a century ago Chaptal proclaimed that no trace of lead, copper, or tin was to be found in the "glaze" of any earthenware fabricated before the thirteenth century; and Mr. Aikin, the best English writer on the subject, adopts the same opinion, and further suggests that some of the lustrous surfaces previously described as glazed might have been produced by mechanical polishing. But there is indisputable evidence that plumbiferous glazes were employed by the Chinese, the Arabs, and other Orientals at a much earlier period, though not, perhaps, so frequently as the silico-alkaline glazes. From the very varied proportions of the lead in the different specimens which have been subjected to a rigid analysis, we are disposed to conclude that they have been the result of tentative processes, and that the lead might have been first used merely as a flux.

Nearly all writers on the subject ascribe the invention of the plumbiferous and vitreous glaze to Stezlstadt, a potter of Alsace, in or about the year 1283. The only authority we can find for this assertion beyond tradition is the following passage in the Annals of Colmar. "Obiit figulus Stezlstatt qui primus in Alsatia vitro vasa fictitia vestiebat;" that is, "This year (1283) died the potter Stezlstadt, who first, in Alsace, covered earthenware with a glaze." To us this passage seems to indicate merely that he introduced the process into Alsace, not that he was the original inventor. We are the more confirmed in this opinion from having seen the fragments of two vases taken from a tomb in the ruined Abbey of Jumiéges, bearing the date A. D. 1120, which were indisputably covered with a plumbiferous glaze. Passeri, to whose authority we think that sufficient attention has not been paid, declares that plumbiferous glazes were used at Pesaro, in Tuscany, A. D. 1100; but it is not easy to understand what he means by the phrase "chalk of lead," which he describes as the principal material, unless it be the ordinary white lead of commerce. From the great commercial intercourse between the cities of Tuscany and the Saracenic settlements in Spain, we may reasonably conjecture that this manufacture was introduced into Europe by the intervention of the Arabs, who probably derived it in the first instance from the Chinese. *

The encaustic tiles found in the ancient abbeys of England and Ireland, to which so much of public attention has recently been directed, are unquestionably covered with a plumbiferous glaze; but, from the arabesque character of the ornaments, we are led to conclude that they

* In confirmation of these views it may be mentioned that the term "sagger," the case in which articles are placed to be fired, is clearly derived from סגר, "sager," which both in Hebrew and Arabic signifies "to shut up" or "enclose."

must have been imported from Spain. Their date appears to range between the thirteenth and sixteenth century, and there is no trace of any manufacture of glazed or enamelled ware having existed in England until a much later period.

It is uncertain when tin was substituted for lead in the metallic glazes. The first specimens of the stanniferous glaze of which we have been able to find any record were used to decorate a pleasure-house erected by Francis I in the Bois de Boulogne: they were wrought by an Italian, Girolamo della Robia, the nephew of a celebrated potter, named Luca. Passeri mentions this potter, and obscurely intimates that he made some discoveries in the composition of glazes; and Brogniart, without citing his authority, asserts that this Luca, whom he calls the grand uncle of Della Robia, was the inventor of the stanniferous glaze.

We know of very few specimens of copper being used in the metallic glazes: the most definite and remarkable have been brought from Japan, and are in the Museum of the King of Holland. The commercial jealousy of the Dutch prevents these from being subjected to any scientific analysis; but we should recommend some tentative experiments to be made on the application of copper to glazing, as we doubt not that it would lead to some beautiful and unexpected results.

The earliest glaze employed in England was that of pulverized lead ore, first used about 1670; but it was soon superseded by the salt glaze, which was discovered by accident. A farm servant was boiling a powerful lye of that article for culinary purposes. During her temporary absence the liquor boiled over, and formed a smooth glassy coating on the outside of the earthen vessel which had contained it. The application of this discovery is said to have been made by the brothers Elers (of Nuremberg), who began business as potters at Burslem in 1690. Their works were small, and the operations conducted with strict secrecy, every man being locked up in his workshop and subjected to the rigid surveillance of the principals; but, finding it impossible to evade the stratagems employed to discover their secrets,* they removed to London, and established the Chelsea Pottery about 1720. This glaze was discontinued in the latter part of the last century.

Since the period referred to we are able to trace clearly the very numerous changes and improvements to the present time. It is certain, then, that the original importance of the district in connexion

* One trick of many was the following:—A potter of the name of Astbury feigned idiocy, and got admission to the works. His apparent infirmity placed him above suspicion, and he was employed to tread the lathe, the construction of which he studied by day, and made a model of it at home in the evenings! This dissimulation strange as it may seem, was kept up for two years, when Astbury, having made himself acquainted with every process that seemed desirable, quitted his employers, and soon began potting on his own account.

As a pendant to this anecdote we may add the following:—About the year 1720 a potter traveling to London discovered an ailment in one of his horse's eyes. At Dunstable he called the attention of an ostler to the circumstance, who readily set about curing it, for which purpose he put a common flint stone into the fire, and, having calcined and reduced it to powder, he blew a portion of it into the diseased eye. The whiteness of the powder attracted the traveler's attention, and he resolved to test its applicability to the purpose of his business. The result was emi-

with potting arose from its richness in native clays, of which it possesses great variety, of high ductility and tenacity; but these are all colored, mostly very dark, and not one particle of them now enters into the composition of the famed productions of the Staffordshire Potteries. At an early period, the orange, blue, and other light-colored clays were reduced by mixture with water to slops, technically called *slips*, and used in ornamenting the dark brown bodies; and when it was discovered that Devonshire and other parts of England afforded excellent clays of pure white, these were imported to be employed in a similar manner—merely as *slips* for ornamentation. At the present day, however, the potter, in all cases, requires this virgin white clay, which he compounds and colors at pleasure; so that it has entirely superseded, for the *body*, the material it was introduced to *decorate*. Still, since, in the gradual advancement of the art, it was found necessary to expose the ware to intense and long continued heat, and the practice was adopted of enclosing it in large cylindrical earthen vessels of great thickness, as safeguards, called "saggers," the common marls and clays remain indispensible for the construction of these vessels. Another important requisite—fuel—had, doubtless, great influence in fixing the earthenware manufacture on this spot, for the district of the Potteries is placed in the very centre of the great North Staffordshire coal-field. *

The history of earthenware manufacture in England is so closely associated with that of one great mind as to be almost inseparable from it; not merely because the manufacturer owes to him its advancement in the substantial qualities of tenacity and durability, but also its alliance with Art, and that of the highest order;—we allude to Josiah Wedgwood, who in the latter half of the last century, to quote from the memorial on his tomb, "converted a rude and inconsiderable manufacture into an elegant art and an important part of national commerce." His beginning in 1760,† was humble enough:—Making knife handles, tiles, &c., in which articles it appears he did what is called "a good business," so good, indeed, as to induce him to take a second manufactory, where he advanced to the fabrication of white stone ware, with figures in relief. His success was so great that he

nently successful. "Other potters soon discovered the source from which the superiority was derived, and did not fail to follow his example. For a considerable time they pounded the flint stones in private rooms by *manual labor*, but many of the poor workmen having suffered severely from the dust of the flint getting into their lungs and producing coughs, consumption, and other pulmonary diseases, and the demand for the powder daily increasing, they were induced to try to grind it by mills of various constructions, which, succeeding, became afterwards exclusively adopted." Thus by accident was suggested another important improvement—the use of flint.

* It is worthy of remark that the coals lie nearer to the surface than in any other part of the kingdom; the coals in some of the pits being actually drawn up an inclined plane.

† In this year, 1760, "to supply persons of wealth and taste," a kind of white ware was imported from France. This ware, it seems, was very superior to any at that time made in England—the sole attention of our potters being given to the production of a cheap article, without reference to elegance of form and neat execution. This seemed to threaten the very existence of our manufacture, and led Wedgwood to a series of experiments which resulted in the invention of "a kind

subsequently engaged a *third* manufactory, and opened a warehouse in St. James's-square, London, where he took a partner named Byerley, a gentleman of taste and talent, through whose acquaintance with persons of wealth he procured the loan of valuable works of Art. Sir W. Hamilton supplied him with specimens from his collection of Herculaneum vases, &c. Many of his copies equalled the originals; and so rapid was his progress that he soon found himself on the highway to fame and fortune—both of which he acquired. *

Wedgwood saw from the first that it was by prosecuting potting as an art that success must be gained, and he wisely called to his aid men of genius whose remuneration was as liberal as the enterprise which engaged them was enlightened. Of these the chief was the great and good Flaxman, to whose co-operation Wedgwood was indebted for some of his finest designs. "They consisted," says Cunningham, "chiefly of small groups, in very low relief—the subjects from ancient verse and history. I have seen and examined numbers of them, and many are equal in beauty and simplicity to his designs for marble." We wonder not at Wedgwood's success: the wonder is that his example should have found few or no imitators in the district where he met with such deserved rewards. †

Many years ago, the late Mr. Enoch Wood, of Burslem, commenced the formation of a Pottery Museum—intended to show the progress of the manufacture, by exhibiting specimens of the various wares made in the district, from the earliest date up to the present time. His

of ware wholly unique in appearance, and bearing a brilliant glaze; of compact body, possessing every requisite for its intended purpose, and made with ease and rapidity." This obtained royal patronage (in the year 1763), and was called "Queen's ware," by command of her Majesty Queen Charlotte.

* When the Barberini Vase was on sale, Mr. Wedgwood became a bidder against the Duchess of Portland; his offers exceeded those of her Grace, until the Duke, ascertaining who was the person so bidding, and the cause of his doing so, promised to lend it to him for an indefinite period if he would withdraw his opposition; thus her Grace became the owner. Mr. Wedgwood copied it, and sold it is said, fifty of them for £50 each, to subscribers. This beautiful vase has often been quoted as evidence of the great degree of excellence to which the ancients had arrived in the manufacture of *porcelain*. It was discovered in the tomb of Alexander Severus, who died in the year 235. But this exquisite specimen of workmanship, being made of glass and not of porcelain, is no confirmation of the above assertion.

† In the passage from which the above is taken, the writer goes on to say:—"Before those days, the porcelain of England had but little external beauty to recommend it in the market. The greatest work of that kind was the famous 'Royal Oak Dish,' an immense soup plate, of nearly two feet diameter, covered by a spreading oak, with Charles, sceptered and crowned, amongst the branches,—his wig floating in vast redundance; *and every golden acorn as large as the king's head!*" "To excel such works was certainly not difficult, but Flaxman did more than excel them. The Etruscan vases and the architectural ornaments of Greece supplied him with the finest shapes, and these he embellished with his own inventions; and a taste for forms of elegance began to be diffused over the land. Rude and unseemly shapes were no longer tolerated; and the eye, growing accustomed to elegance, desired to have this new luxury at table." Flaxman, so far from being ashamed of such labors, "loved to allude to them":—an example that we hope will have the effect of breaking through the barriers which have hitherto interposed between the artist and the manufacturer. To effect this necessary consummation has for years been a great object of our labors, and that our efforts have not been fruitless, every day brings us some agreeable and conclusive testimony. For on this union, and on this alone, now depends the continuance of our supremacy as a manufacturing nation.

object, we believe, was not fully attained, but sufficient was done to show the feasibility and value of such a project. At Mr. Wood's death the collection passed into the hands of his son; and as circumstances much to be regretted, have occurred which render it likely that the collection will be disposed of, we earnestly hope it may come into the hands of some public institution—perhaps the British Museum.

The wares made in the Potteries are of many kinds, but the principal are comprehended under three heads. First, the common ware, made of the native marls and colored clays; and these are now used for the commonest domestic purposes, for flower-pots, &c. The second comprises earthenware of a superior quality, made from the white clays of Devon, Dorset, and Cornwall,* compounded in various ways (almost every master potter having his own *secret*); all the wares of this class are of an opaque body. The third consists of porcelain (locally called *china*), the best kind of ware, being exquisitely fine in texture and semi-transparent; it was made at the Chelsea Pottery, London, nearly half a century before its introduction into the Potteries, which took place about 1765, at Burslem; but, not being at first encouraged, it was discontinued for a while, probably in consequence of Wedgwood's "Queen's ware" being then the fashion. About 1767, the first application of PRINTING from copperplate engravings was made. The process was invented and first applied by a Liverpool engraver, to whom the ware was sent for ornamentation by that mode. The color originally employed was blue, and it was the *principal* if not the *only* color used, during many subsequent years. The first complete printed table service, made in England, was, we believe, in 1780. The pattern was the famous and execrable Willow.

Our object is now to explain the necessary care with which THE POTTER'S CLAY IS PREPARED. First, in the preparation of the two principal ingredients—flint and natural clay; and afterwards in the blending of them together. The flint stones are first calcined; this is

* The Cornish clay is the best quality, and is technically termed by potters China clay, and enters very extensively into the composition of the best kind of ware. It is the decomposed felspar of the granite, and is prepared by the clay merchants themselves in Cornwall prior to its being sent to the Potteries. Huge masses of white granite abound in Cornwall, which is in some parts found partially decomposed; and where this is the case the mineral is raised and prepared for the potter's use, it having been discovered by Mr. Cockworthy of Plymouth, in 1765, that it furnished the true "kaolin," and also the "petuntse" of the Chinese.

The following is the method of preparation:—The stone, having been broken up by a pickaxe, is laid in a stream of running water; the light argillaceous parts are thus washed off and kept in suspension; the quartz and the mica, being separated, are allowed to subside near the place where the stone was first raised. At the end of these rivulets are a kind of catchpools, where the water is at last arrested, and time allowed for the pure clay with which the water is charged to separate from it, which being effected the water is drawn off; the clay is then dug up in square blocks and placed upon a number of strong shelves called "linnees," so fitted as to allow a circulation of air in order that the clay may be properly dried. Thus prepared it is extremely white, and in the state of an impalpable powder. It is then forwarded to the Potteries under the name of China clay.

Some of the Cornish granite itself is often used with the clay, on account of its binding quality, it being naturally more fusible than the earths usually employed; for it is a remarkable fact that neither clay, silica, nor lime will melt singly; but by mixing these three species in due proportions the greatest degree of fusibility is attained.

effected in a kiln similar to that used for lime-burning. These stones are spread with alternate layers of coal, and the burning is usually completed in about twenty-four hours. They are then white and very brittle, and ready to be crushed by the "stamper"—a machine composed of upright shafts of wood, six feet long and about eight inches square, heavily loaded with iron at the lower end, which, by means of other machinery, are made to rise and fall in succession on the flint, contained in a strong grated box. It is then removed to the GRINDING vats, which are from twelve to fourteen feet in diameter, and four deep, paved with chertstone, large blocks of which, being also worked round by arms connected with a central vertical shaft propelled by an engine, become a powerful grinding medium. This peculiar stone is used because of its chemical relationship to the flint, which, therefore, suffers no deterioration from the mixture of the abraded particles which necessarily result from the friction—a matter of serious consideration. In these vats the flint is ground in water until it attains the consistency of thick cream, when it is drawn off, and conveyed by troughs into the washing-chamber. Here it undergoes a further purification; more water is added and it is kept in a state of gentle agitation by means of revolving arms of wood, thus keeping the finer particles in suspension while the liquid is again drawn away in pipes to a tank below. The sediment is afterwards reground. The cleansing process is not yet complete, for when the flint has passed into these tanks, to about half their depth, they are filled up with water, which is repeatedly changed until the flint is considered sufficiently fine and free from all foreign matter. It is then fit for use. The clay of course requires no grinding. It is received from the merchant in lumps of from five to ten pounds each, and sometimes in a dry state in casks. When required for use it is worked with water in a similar manner to the flint, until it attains the same degree of fineness and fluidity. The next stage is the MIXING; for which purpose the different slips (*i. e.*, the fluid clay is so termed, technically) are run off successively into the blending reservoir, against the inner side of which are gauging rods to regulate the quantities of each to be admitted. The mixture is now passed into other reservoirs, through fine sieves, or lawns, woven of silk, and containing 300 threads to the square inch. * Finally, the slip is conveyed to a series of large open kilns, heated underneath by means of flues, and about nine inches deep. This is to evaporate the superfluous moisture, which is generally effected in twenty-four hours, by which time it becomes tolerably firm. It is then "cut into large blocks and conveyed" to an adjoining building, to undergo the process of MILLING. The mill is of iron, in the form of a hollow cone, inverted, with a square aperture or tube at the lower part. In the centre is a vertical shaft set with broad knives. When this shaft is in action, the soft clay is thrown in and forced downwards, being alternately cut and pressed until it exudes from the aperture at the bottom in a perfectly plastic and smooth state. It is now ready for the hand of the potter.

* A pint of "slip" of Dorsetshire or Devonshire clay weighs 24 oz. of proper consistence; a pint of slip of Cornish clay, 26 oz.; and of flint, 32 oz.

The preparation of porcelain clay is similar, but more complicated, and involves more serious risks. The qualities necessary in good porcelain are—a sound compact body, white, semi-transparent, and capable of bearing a rich and shining glaze; not liable to discoloration or "crazing," and being proof against sudden variations of heat and cold. The qualities in which porcelain differs from earthenware are those which are most difficult to realize; and the production of excellent specimens of either is by no means always a matter of ease and certainty, even at the best manufactories.

(To be continued.)

On the results of an extensive series of Magnetic Investigation, including most of the known varieties of Steel. By W. PETRIE.

The following is an abstract:—

Process of manufacture to produce permanent magnets, having the greatest fixity and capacity conjointly secured.—1. The original iron should be the purest soft iron, *charcoal made* (not coke;) the Swedish, from the *Dunnamore* mine, is better than any other. 2. Converted—with pure *charcoal;* it should be carbonized *lightly*, and the process to be stopped when the bars, of the usual thickness, are "*scarcely steel through*," yet so that it will harden with certainty, without an undue heat. 3. Sorted—with attention to homogeneous conversion, &c., according to the ordinary rules. 4. Melted—the pot kept covered, and not longer than is necessary in fusion. 5. Cast—into a large ingot, so as to allow of its being *well* rolled out singly, before it becomes reduced to the requisite thinness. 6. Rolled—while hot from casting, to save a second heating; it should not be doubled over, nor sheared and faggotted; the rolling should be conducted at as low a temperature as convenient, as it thereby acquires a harder, closer texture, and finer grain. 7. In cutting into shape, the substance (if large, or of varied form,) should not be strained, as by boring with "*rymers*," or straightening (oftener than is unavoidable) with the hammer, as it is then apt to warp, and to have unseen commencements of cracks on becoming subsequently hardened. More carbonization than that previously described as best is of little injury to the magnetic goodness of the steel, provided it be so prepared as to preserve a homogenous and *white* appearance of fracture when hardened, which is not so easily managed as with that of lower carbonization; but if it be again carbonized *more* than usual, (as razor steel, or above that,) it rather improves; and again an increase deteriorates it as in cast iron, and a further increase again improves it. In short, *in the scale of carbonization there is a succession of continually decreasing maxima of advantage.*

On the physical properties which the steel should possess.—The fineness of grain is affected by many adventitious circumstances, which must be considered and allowed for in judging of it; and the most important fact is the difference between the appearance in the *hard*

and *soft* states: for in the general properties, whether optical, mechanical, or magnetical, their order, in any set of samples, is *reversed* in the hard state, independently of the absolute change in each property. The steels should be examined by breaking with a *single* bend at a file notch (notching with a chisel, bending back, &c., change the appearance.) A microscope of 6 or 10 lineal power is better than any other power for examining it. The *general* properties, without going into detailed description, should be as follows, the terms being comparative with other samples of less value, and not at all with the hard or soft states of the same steel:—

In a soft state.	*In a hard state.*
General appearance, uniform darkish grey.	Uniform white.
Rather a large grain, compared with razor steel (or finer if much rolled.)	A smaller grain than it was before.
Rather irregular in size and shape of grain unless fine. Rounded crystallization.	Rather more regular than before.—*Rounded* crystallization disappears.—Grains individually distinct, with good metallic lustre.
Close texture, without cavities.	Not particularly close.
Rather tough for steel.	Brittle and very hard.
Attracted considerably before magnetizing.	Ditto.
Loses induced magnetism more freely than other steels.	Retains magnetism well and abundantly.

Care must be taken to discriminate between real cavities and indentations arising from the crystals being torn up, by the breaking; pure iron often appears porous from this cause.

Then followed some peculiar considerations on the chemical constitution and molecular arrangement of certain sorts of steel; and on the molecular peculiarities of iron and other metals, in connexion with their magnetic capacity, illustrated by a tabular arrangement.

On hardening, &c.—In the ordinary process there is risk and difficulty for large work, owing to unequal heat, unnecessary time and heat applied, especially to fine edges, decarbonization, scaling, &c. These are obviated by a process which is new, as applied on a large scale, namely, heating in melted lead. It will be observed that the *precise* heat is imparted, quite uniformly, in half a minute or so; and the finest edge is heated momentarily no higher than the thickest part, rendering this process incomparable for all instruments where it is the edge or smaller parts that are of importance. *No scale is formed*, the finest polish or sharpest edge being preserved through the hardening. The previous preparation of the steel and some other points are described; and particulars of the manner of refrigeration in water (salt) and for securing hardness and great evenness, are also detailed. The process has been applied to steel sheets of 10 inches by 20, obtained quite flat, and as hard as a file throughout, even at the middle parts, which has hitherto been found very difficult—we may say impossible. Magnets, prepared by these means only, differ generally in magnetic power by $\frac{1}{40}$ part, many being absolutely equal. Particulars are then given of the advantage of certain high powers for magnetizing bars, and of an apparatus constructed, weighing 2 cwt., and possessing nearly as great aggregate power as the colossal magnet in possession

of the Royal Society (weighing, we believe, 2 tons.) A method is suggested for verifying the constancy of magneto-meteorological instruments, by means of the terrestrial magnetism itself, independently of its own variations, or of the comparison of the mutual action of three or more bars.

'On the mode of developing the Magnetic Condition.' By Dr. Scoresby.—Dr. Scoresby stated that he had, at York, shown a new and superior mode of developing the magnetic condition in properly prepared and hardened steel bars, by interposing a thin plate of soft iron between the operating magnet and the bar of steel to be magnetized. He had, at that time, supposed it to be necessary to extend the thin plate of soft iron the entire length of the bars of steel to be magnetized. But he had since found this to be by no means the case; since by laying any number of unmagnetized bars of steel in a long line, and passing along them a horse-shoe magnet with its poles connected with a thin polished plate of soft iron (he used common hoop iron), the ends being slightly bent upwards to cause it to pass more freely over the steel bars, and then turning them over and renewing the process on the other face, he found he could communicate to the bars the full charge which they were competent to receive. The Rev. Doctor exhibited this experiment; and by simply passing a horse-shoe magnet thus armed with an interposed piece of sheet iron, once over each face of twelve previously unmagnetized bars of steel, he communicated to them so much power as that they sustained their own weight, when held up as a chain.

Mr. Broun said, that if Dr. Scoresby, or some other equally competent person would turn his attention to the influence of alterations of temperature on the power of a magnet, or could discover some means of rendering the power of a magnet independent of the ordinary changes of atmospheric temperature, he would confer a benefit on persons engaged in magnetic researches. Lond. Athenæum.

Preservation of Timber, Hemp, Linen, &c., by Sir William Burnett's Method.

We have, on several previous occasions, called attention to the antiseptic qualities of chloride of zinc, as used in the patented process invented by Sir Wm. Burnett, for the preservation of timber, cordage, sail-cloth, and every article in hemp, flax, cotton, woolen, &c.; and we find that the experiments which have been continually carried on, not only establish the successful effects of its use on all materials to which it was first applied, but various other important uses for its agency have been discovered. Its effects on timber are remarkable, hardening and improving the texture, entering into perfect chemical combination with the ligneous fibre, and it never afterwards exudes through the pores, and no amount of washing or boiling can remove the chemical compound. Canvas, cordage, &c., is effectually preserved from mildew, rot, &c., without being in the least discolored, while they are rendered still more pliable. On every description of

manufacture, composed of flax, silk, cotton, or wool, it has a similar effect—preventing every attack of decay, and rendering them fire-proof, when the solution is used of sufficient strength. In addition to these valuable properties, it is now employed in the dissecting room, to prevent nauseous effluvia from the decomposition of the muscles during the continuance of a lecture, which sometimes lasts a fortnight or more; its action on putrid flesh is almost magical; from a certificate of W. V. Pettigrew, Esq., we find that, in February, while lecturing on the superior extremity, an arm was employed, which was quite green and highly offensive; but, by injecting the veins with the chloride of zinc, it was restored to its fresh condition, and lasted throughout the lecture, from the 3d to the 28th February; green hides are most economically treated in this way, and their offensive smell removed. Its effect on some substances held in solution in water is most powerful; and hence it has been discovered, that it most effectually removes the unpleasantness and danger of putrid bilge water on board ship. No better test can be given, as a proof of its action in this respect, than on a decoction of logwood, which it is well known, may stand for months without any precipitate taking place, but, on adding a few drops of the solution of chloride of zinc, the whole of the coloring matter is immediately precipitated, leaving the liquor clear. When the chloride of zinc has been injected into any of the substances, such as timber, canvas, &c., it becomes so chemically united, that even the saw-dust of a piece of prepared timber, when operated on by an eminent chemist, gave out only 23 per cent. of the quantity of the chloride contained. The Government authorities are so thoroughly satisfied of the importance of the process, that in addition to the tanks already in use in the various dockyards, which are 50 feet long by 6 feet diameter, four gigantic cylinders are now being constructed for exhausting purposes—they are to be 86 feet long and 6 feet in diameter, and are intended for Woolwich, Portsmouth, Pembroke, and Plymouth. The progress of railway construction in Belgium is expected to bring a considerable increase of business to the company; they have already two contracts for preparing a large number of sleepers, which will be transported hither, prepared in the works at the Isle of Dogs, and re-shipped for Belgium, free of duty—arrangements having been made with the authorities for that purpose. It has occurred to us very forcibly, that one very important use, to which this principle might be applied, has been omitted—viz: to the preservation of paper for manuscripts and printed works; it, of course, requires consideration as to the best stage of the paper manufacture for its application, but that could soon be determined by experience. It strikes us that the most effective, as well as most economical moment, would be the application of the solution to the pulp, just before passing the drying cylinders; or, for the preservation of printed works, the paper might be damped down with the solution, instead of common water. We merely throw out the suggestion.

Min. Jour.

On the Cohesive Force of Water.

In the course of a very interesting lecture, at the Royal Institution, Professor Faraday explained that water was known to us in three states—the "solid," in the state of ice, where the greatest attraction existed between its particles, and it required some amount of mechanical force to separate it—the "liquid," where its particles were less attracted towards each other, and were free to move—and the "vaporous" state, where its particles were still more further separated by heat, and possessed little or no attraction towards each other. It was of the cohesive force of water in its fluid form that he was about to speak; and it must also be remembered, that what is true of this force in water, is also of all liquids. The Professor then showed an experiment, well known as exhibiting the adhesion of water. A plate of glass is suspended from a balance over a small basin, and so accurately counterpoised by weights, that the addition of even a grain would turn the balance. If in this state water be poured into the basin, so as barely to touch the under surface of the glass plate, it is found that it will now support a further weight of 1½ ounce placed into the opposite scale. And this is owing to two forces which now come into action; first the adhesion of the water to the glass, and then the still more powerful adhesion of the particles of water among themselves. This phenomenon was, till very lately, attributed to capillary attraction; but Dr. Henry, of Princeton, conceived that it must be due to other causes, and he was induced to make a variety of experiments on the matter, and the results arrived at, proved that the cohesive force of every square inch of water is equal to several hundred pounds. The Professor next referred to the experiments of the young philosopher, Donne, which are but little known in this country. Donne has found that, where water is carefully deprived of the air in solution, it may, if there be no breach of continuity among the particles, be raised to a height of 100 feet; while, under ordinary circumstances, 30 feet in round numbers is the greatest altitude at which it can be supported. The phenomenon depends also upon the strong cohesive force residing in these particles of water when deprived of all extraneous matter, for the moment a little bubble of air is let in—that is to say, the moment a breach of continuity occurs, the water obeys the natural laws and finds its own level. The other important fact made out by the experiments of Donne, is as follows:—Water carefully deprived, by boiling, of all the air in solution, instead of boiling at 212°, the boiling point of water, under ordinary circumstances, may be raised to 275° Fahr. without showing any signs of ebullition, as long as the continuity of the particles of water is not broken. Thus, a force equal to three atmospheres, is restrained only by the adhesion of the particles of water. At the temperature of 275°, it suddenly bursts into ebullition, with a loud explosion, dashing the containing vessel into fragments. May not steam-boiler explosions be sometimes thus accounted for? The Professor lastly referred to the experiments of Boutigny; which, however, have been so often repeated in this country, as to be familiar to all students of science. The experiments

of freezing water and mercury in a red-hot vessel were then exhibited, as before explained in this journal. Ibid.

Applicability of the Gun Cotton to Mining Purposes.

At the annual meeting of the Royal Geological Society of Cornwall —which was held last week at Penzance—Mr. R. Taylor gave an interesting account of some experiments made in the neighborhood of Penryn, for the purpose of testing the applicability of Prof. Schönbein's invention to mining purposes. We extract the following particulars:—One hole was charged with powder, and another with a quarter of the weight in cotton—the latter tore the rock in atoms, in fact did more than was required. They then went to another and more dense rock, and put into a hole 13½ ounces of powder; in a second hole in the same rock, 3 ounces of the cotton—less than a quarter part—was deposited, which did the work to the complete satisfaction of all present, and equal to the powder. Other experiments were subsequently made; and Mr. Taylor found that in some cases *one-sixth* of the charge of the cotton as compared with the powder did its work. In tamping, &c., the cotton was found to be all that could be desired—and Mr. Taylor was enabled to state that, throughout, the experiments were eminently successful, and that a *fourth* part of the weight of powder, in cotton, would be found to be about its strength. With regard to its effects on the air in mines, he might refer to an experiment made at Restormel Iron mine, which was not very easy of access to the adit level, which was at a great distance in the mine —they tried the cotton at the extreme end, which was some 600 or 700 fathoms from the entrance, and the lode was in hard ground. Two holes were prepared, both of which were charged with the cotton—one with a *quarter* the weight of powder usually used, and the other with *two-sixths:* the holes were fired, and the cotton tore the ground to the complete satisfaction of all present. Had the explosion taken place from powder, they would not have been able to approach the holes for at least three-quarters of an hour—but on this occasion, they all went in immediately after the explosion, and experienced not the slightest inconvenience, and all they smelt was what was emitted from the safety fuse. London Athenæum.

Iron War Steamers of Great Britain.

In the House of Commons, on Thursday evening, Mr. Wawn, in conformity to notice, asked the Secretary to the Admiralty, how many iron war steamers were being built? Also, whether any experiments had been tried as to the effects of cannon shot upon iron vessels, and if those experiments had been satisfactory or not? And lastly, whether the Government intended to persevere in building iron war steamers?—Mr. Ward, in reply, said that there were at present, 16 iron war steamers in commission, including the Dover mail-packets; there were four other iron steamers ready, not in commission, including the *Birkenhead*, of 1400 tons and 556 horse-power; and that there were seven other iron steamers building of which one, the *Simoom*, was

1953 tons, and 780 horse-power. As there had been only one experiment made of the effects of shot upon iron steamers, it would be highly improper to pronounce any opinion upon that subject; and, in reply to the hon. Member's last question, he begged to say, that the Board of Admiralty would be extremely cautious in giving any new orders; at the same time, nothing determinate has been resolved on in this respect. Lond. Min. Jour.

Effect of Cannon Balls on Iron Steamers.

At Portsmouth some remarkable results have been produced by the experimental shot practice, from the *Excellent*, on the iron steamer *Ruby*. The shots which hit the *Ruby* not only penetrated the side first struck, but in some instances passed through the other side, carrying with it whole plates of iron. In action, this would risk the total loss of the vessel; for on heeling over to leeward, such a body of water must rush in that nothing could prevent her sinking with all on board. Lond. Mec. Mag.

Vibrating Marine Engines.

The public will be gratified to hear of the excellent performances of the Peninsular and Oriental Company's new steam-ship, the Pottinger, in her first trip from Southampton to Malta. The following is an extract of a letter from a gentleman on board, dated Malta, Oct, 2:—"I am sure you will be pleased to hear of our arrival at Malta, after a very rough passage, in which both ship and engines have been well tried, and have been found most efficient. The ship is strong, and not in the least inclined to strain; the engines are a beautiful specimen of mechanical skill. I have watched their smooth working narrowly, and there have been neither hot bearings, escapes of steam, derangements or breakings of any kind, which to me, from my little experience in steam voyages, is rather surprising. I particularly remarked, whilst off Cape St. Vincent, blowing at the time a smart gale, that the engines made 15 strokes per minute, with abundance of steam, and the bearings as cool as if the machinery was not in motion. I have no doubt the future performances of ship and engines will be as satisfactory, as all on board admit the passage, under the above circumstances, has been." The engines on board the Pottinger are by Miller, Ravenhill, & Co., of Glass-house-fields. They are the largest oscillating engines that have ever been in motion afloat—being 450-horse power, or having cylinders 76 inches in diameter, and seven feet stroke. Lond. Railway Mag.

Account of Mushet's Black Band Ironstone.

Mr. Bald read a paper, at the British Association, on the "Mushet Band," commonly called the Black-band Ironstone of the coal-field of Scotland.—This band of ironstone was discovered, about 40 years ago, by Mr. David Mushet, of the Calder Iron-Works, near Glasgow. It had been frequently passed through; but was thrown away as rub-